Strawberries: Effects of Modifying Irrigation Methods for Transplant Establishment

2009 - 2010 Data

Manzanita BERRY FARMS

REITER AFFILIATED COMPANIES

ITRC moving water in new directions

JOHN DEERE WATER TECHNOLOGIES

ANR University of California UCCE

Ventura County University of California Cooperative Extension

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Project Purpose:

The purpose of the project is to develop an analysis of the current irrigation practices of the strawberry growers on the Central Coast of California. The primary research evaluation is during the establishment of transplants where sprinklers are used even though drip irrigation is available. This project has targeted the impacts of salinity on the young strawberry transplants.

The specific objectives of the project are to: (1) Set up a research areas and control plots on a demonstration scale, (2) determine the key factors that affect the problems in early growth of transplanted strawberries, (3) determine relationships between the use of irrigation water and the control of salinity, and (4) provide a multi-year analysis to determine long term salinity impacts on yields.

This project examines the motives, methods, and need for sprinklers on strawberries. The overall goal of the project is to conserve water by minimizing or eliminating sprinkler use on strawberries. The project is designed to study the current practice and determine the conditions where growers can change these practices. By minimizing sprinkler use, water is conserved, money is saved by pumping less water, and runoff is reduced. This project targets drought management as well as target runoff as a potential source on contaminants reaching waterways.

Irrigation Methods to Evaluate:

The following are the test protocols for the research evaluation:

1. Sprinkler Irrigation Only (SIP) - every day for 4-6 weeks, then switch to drip irrigation (this protocol is referred to as the ***conventional*** approach)

2. Partial Sprinkler Irrigation (PSI) - use sprinklers only for special cases for 3-5 irrigation events (e.g. right after transplanting, during hot dry wind events, frost protection)

3. Drip Irrigation Only (DIO) – every day for the whole season

The key issue with the SIP conventional protocol is the amount of runoff generated during transplant establishment. Estimates range from 50-75% of the applied water will run off the field.

Potential Impact:

Figure 1. 2008 Grower meeting in Ventura

Strawberry growers in the Oxnard Plain and Santa Maria area are cooperating on this evaluation. The Oxnard area has about 1/3 of the state's strawberry acreage and its growers face a significant constraint on the water delivery based on groundwater limitations as well as water district restrictions. However, this project has potential benefits to growers in the other strawberry growing regions of California (Los Angeles, San Diego, Santa Maria, Watsonville, Salinas, and the San Joaquin Valley).

This study will target the impact on production efficiency, productivity, and determine if the revised practices can maintain profitability over the long term of strawberry growers. Strawberries are an expensive crop to grow, but they are vital to California's economy. This research will provide background data on a historical practice that uses excessive water but may actually be necessary for good production values.

Sprinkler issues are present all along the California Central Coast where there is a significant constraint on the water delivery based on groundwater limitations as well as water district restrictions. There are similar practices throughout California and throughout the strawberry growing areas in the country.

Background:

A little over two years ago, the Cal Poly Irrigation Training and Research Center (ITRC) teamed up with John Deere Water Technologies (JDWT) and United Water Conservation District (UWCD) to answer a seemingly simple question that perplexes drivers traveling past strawberry fields: *Why are sprinklers being used to irrigate the strawberry transplants in Ventura County when drip irrigation is available*? When growers were asked their reasons for using sprinklers instead of drip irrigation, they offered a multitude of answers. Since there was no clear-cut reason not to use drip, the project team worked together to answer this question and evaluate new strategies for drip irrigation on strawberries to minimize runoff during transplant establishment. Strawberries are extremely sensitive to water stress and salinity stress, especially at the transplant stage. Currently, the most common method for irrigating strawberries during the season is a mix of sprinkler

Figure 2. 2010 Grower meeting in Camarillo

irrigation and then later switching to drip irrigation. Growers use sprinkler irrigation for bed preparation and salinity control, then eventually switch to drip irrigation. Although the drip irrigation is in place after transplanting the plants, growers continue to use sprinkler irrigation as an insurance policy (bonding between plant roots and soil bonding, washing off the leaves, controlling salinity, frost control, etc.). However, even intermittent use of sprinklers can lead to water loss and pesticide runoff.

Data Collection:

The data has been collected on 3 sites for 2 years:

1. Sammis – Oxnard
2. Eclipse – Oxnard
3. Manzanita – Santa Maria

The data has been reported in this document for the 2009-2010 water seasons only. The following represents the data that has been collected:

1. Water Use
2. Soil Salinity (real time)
3. Plant development (photos)
4. Soil and Water Salinity (laboratory analysis)

Methods and Procedures:

Flow Meters

Magnetic flow meters were chosen for a flow measurement device due to their high reliability, ease of installation, and accuracy. A magnetic flow meter or "magmeter" has no moving parts and does not require the pipe to be full in order to make accurate measurements. It also has the ability to totalize flows and provide an accurate volumetric reading. This was a necessity as all water use numbers would need to be compared volumetrically. Also, magmeters are much less sensitive to turbulent flows than most other flow measurement devices. This allowed the meter to be installed in close proximity to elbows or valves which made the installation very convenient. Both types of magnetic flow meters used are made by SeaMetrics and have a rated accuracy of ±1%.

Ranch Systems Real-Time Data Monitoring

Ranch Systems offers a variety of products to allow active monitoring of in field conditions. Generally this information can be posted on the internet in real-time. It was utilized for this project in order to provide real-time monitoring of salinity, moisture and temperature. Not only would the data be logged, but valuable irrigation scheduling information would be readily available to the growers.

A crucial part of the Ranch Systems setup is a base station that relays all information collected by the nodes to the Ranch Systems network. This allows the information to be presented on the Ranch Systems website and accessed by users. Nodes are the devices which collect field sensor readings and transmit them to the base station. They consist of a solar panel, radio, and, in this case, soil and pressure sensors. Each node was placed close to the flow meter and disc filter installation. This location allowed the solar panel and radio to be placed well out of the way and prevent any damage from normal field operations (spraying, ripping, etc.). Each node was connected to two Decagon 5TE soil moisture/temperature/EC sensors. The 5TE sensors were run down the strawberry bed and placed at a depth of 3" in each of the two middle plant rows. The PS1 pressure switch was connected using a brass T connection to a nearby sprinkler head in order to monitor the duration and frequency of sprinkler irrigations.

Data Logger Installation

Decagon Em-50 data loggers were installed at every site at Sammis, Eclipse, and Manzanita locations. These small data loggers were placed on the southern end of the field, near the middle row. Their compact size allowed them to be placed virtually anywhere in the field without the risk of damage from passing equipment. Each data logger was connected to two Decagon 5TE soil moisture/temperature/EC sensors and one Decagon PS1 pressure switch. The 5TE sensors were run down the strawberry bed and placed at a depth of 3" in each of the two middle plant rows. This ended up being essentially in the center of the field. The PS1 pressure switch was connected using a brass T connection to a nearby sprinkler head in order to monitor the duration and frequency of sprinkler irrigations.

Figure 3. Decagon 5TE Logger at Eclipse

Later in the growing season, it became of interest to monitor soil conditions at deeper levels at the Sammis location. This was accomplished by adding two additional 5TE sensors at each of the three Sammis sites. These were installed at depths of 6 and 12 inches. These sensors helped to analyze the data at a deeper level and see how rain and sprinklers affect salinity levels deeper in the soil.

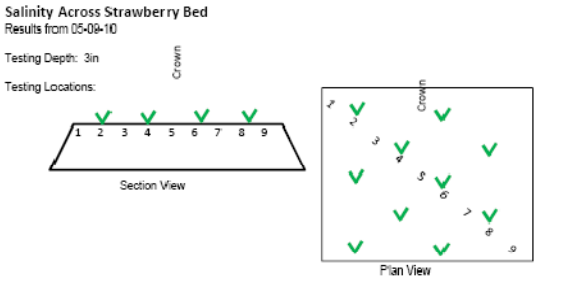
Data collection of the Decagon loggers consisted of visiting each site and downloading the logged data on to a laptop. This was done on a weekly basis during the period of transplant establishment. This allowed for frequent analysis of soil salinity levels during the most sensitive growth period. During the later stages of growth, data was collected on a bi-weekly basis as the strawberry plants are much more resistant to salinity during this period. Generally, the data loggers required little maintenance. Once throughout the season, the batteries had to be changed and occasionally a 5TE sensor would fail. They proved to be much more useful than the Ranch Systems sensors.

Soil Sample Procedure

Periodically throughout the growing season, soil samples were taken in order to monitor the specific salt concentrations present in the soil. This was done by pulling samples from 0-3", 3-6", and 6-12" from the two middle plant rows. The EC and soil moisture content were also checked at each of the three depths using a handheld Decagon ProCheck device with a 5TE sensor. The samples were taken from near the center of the field close to where the 5TE data logger sensors were located. The locations of the samples vary somewhat between dates but for a given date, each sample was taken from the same spot in each field.

Salinity "Snapshot" Procedure

In an attempt to track the movement of salts, EC measurements were taken across the top of the strawberry bed at a depth of three inches at several points throughout the growing season. This was done using a handheld Decagon ProCheck device with a 5TE sensor. These measurements were generally taken near the middle bed at both the north and south ends of each field. The locations of the measurements vary somewhat between dates but for a given date, each measurement was taken from the same spot in each field.



Sammis

Block A	Drip Only							North Side
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	0.3	6.7	9.2	9.1	12.5	9.4	9	10.6	10
%VWC	24	27	26	34	30	29	29	28	25
									South Side
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	0.4	8	5.3	13.7	11.4	10.8	9	0.6	12
%VWC	24	32	33	24	32	28	24	24	23

Figure 4. Sample of salinity snapshot at Sammis. Block A

Water Sample Procedure

Water samples were taken whenever it was possible. This gave some idea as to the quality of the irrigation water that was being used at each site. A Eutech, waterproof, total dissolved solids tester was used to test samples taken from running sprinklers. This was often done at a site that was not a part of the study but at one of the Sammis, Eclipse, or Manzanita locations. It was assumed that each location was using the same water source to irrigate all of its fields.

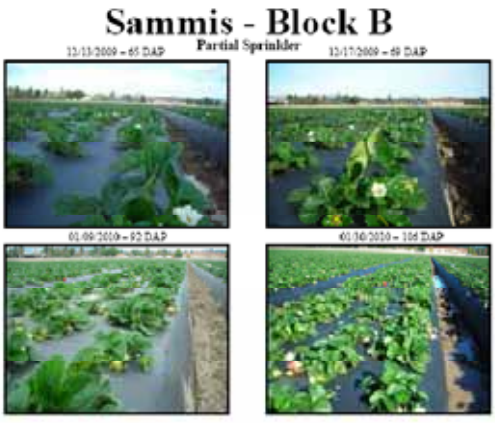


Figure 5. Sample of plant photos at Sammis. Block B

Strawberry Plant Photo Procedure

Pictures were taken of each test site during each visit. This allowed the growth process of strawberries at each site to be monitored and later compared. All pictures were taken from the same location (facing north) from the location of the data logger in each field.

The photos are then uploaded onto computers and compiled into photo databases based on the location of the photos. The photos are used as a visual reference to the growth of the strawberries.

One of the best indicators of the health of the transplants during establishment has been the evaluation of the photos.

Office Procedure

The data from the sensors is uploaded to a spreadsheet. This spreadsheet contains data from the entire study, displaying salinity levels in both water and soil. They also contain precipitation data, as well as number of minutes the sprinklers were running. All of the data is collected from the fields except for the precipitation data. The precipitation data is obtained from the Weather Underground website (www.wunderground.com), using the nearest airports as the location. After all of the data is uploaded into the spreadsheet, graphs are made to visually monitor the salinity levels.

The salinity levels displayed in the graph showed some common trends. The salinity levels fluctuated daily. There were noticeable drops in the salinity level after periods of rain. This would indicate local leaching had occurred near the sensors. Then the salinity levels would begin to rise after the rain subsided. However, this held true to the sensors only in the 0”-3” range. The sensors deeper than that did not record as prominent of a fluctuation as the 0”-3” range. This would indicate there wasn’t a lot of downward movement of the irrigation water.

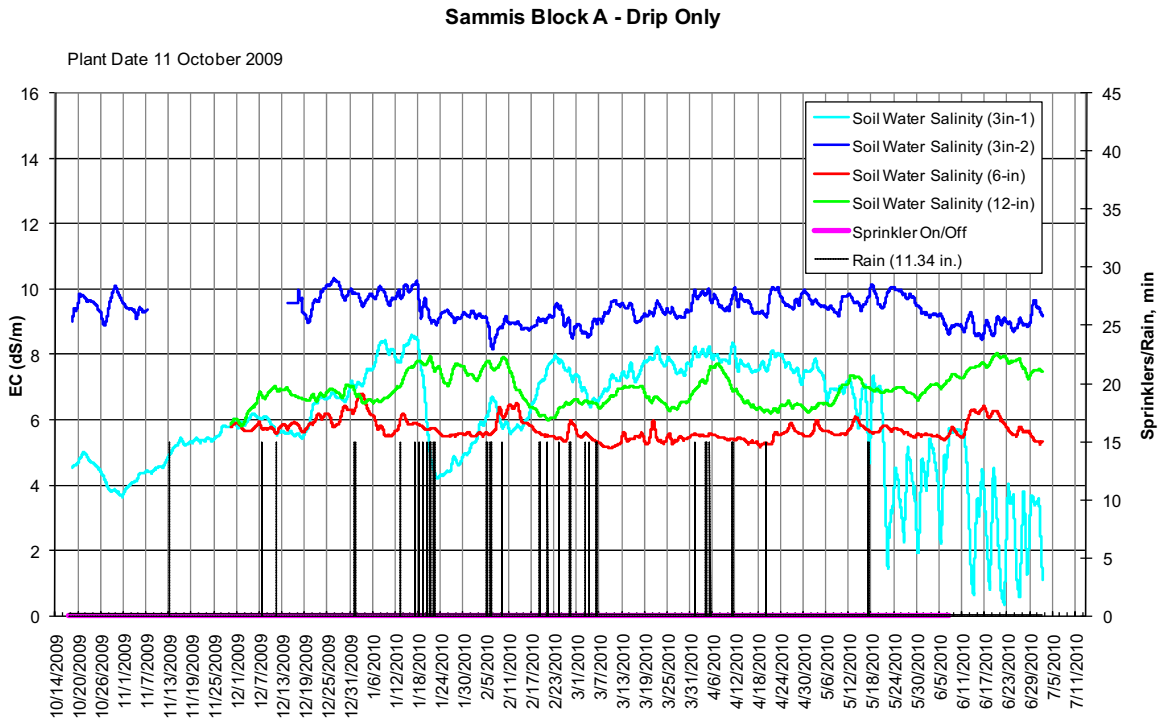


Figure 6. Sample salinity sensor tracking from Sammis Block A

Impact on Yields:

The yields in the first season showed that there was little impact due to the irrigation method. However, in the first season there was noticeable damage to plants where the salinity levels were very high due to the placement of the drip irrigation tape. The conclusion was that even though there was some die-off, the other plants seemed to respond better to keep the yields about equal. The other conclusion was that drip tape placement was important.

The second season yields have shown that the yields are higher with the new irrigation protocol. The yield increase in Manzanita was 13% on the PSI protocol compared to the SIP conventional protocol. The grower also reported the yields on the PSI protocol resulted in early field gains at a time when the market prices were favorable.

The data from Sammis in 2009-2010 has also shown that the yields have improved using the new irrigation methods. The PSI protocol had an 8% increase in yield and the DOI protocol had a 13% increase in yield.

Table 1 – Yield Data from Sammis (2009-2010)

	Cartons per Event			Cumulative Totals		
Date	Reduced Sprinkler	Drip Only	Conventional	Reduced Sprinkler - Cumulative	Drip Only - Cumulative	Conventional - Cumulative
12/26/2009	0	0	0	0	0	0
1/2/2010	0	0	0	0	0	0
1/9/2010	24	31	17	0	0	0
1/16/2010	46	55	35	24	31	17
1/23/2010	40	52	57	70	86	52
1/30/2010	40	21	5	110	138	109
2/6/2010	101	141	93	150	159	114
2/13/2010	7	15	21	251	300	207
2/20/2010	132	85	97	258	315	228
2/27/2010	79	155	63	390	400	325
3/6/2010	102	134	104	469	555	388
3/13/2010	283	219	212	571	689	492
3/20/2010	461	435	515	854	908	704
3/27/2010	313	346	261	1315	1343	1219
4/3/2010	432	467	435	1628	1689	1480
4/10/2010	356	204	319	2060	2156	1915
4/17/2010	215	183	187	2416	2360	2234
4/24/2010	232	341	233	2631	2543	2421
5/1/2010	424	320	390	2863	2884	2654
5/8/2010	299	249	259	3287	3204	3044
5/15/2010	389	392	440	3586	3453	3303
5/22/2010	457	380	327	3975	3845	3743
5/29/2010	472	362	476	4432	4225	4070
6/5/2010	346	329	394	4904	4587	4546
6/12/2010	22	94	66	5250	4916	4940
6/19/2010	118	140	81	5272	5010	5006
Totals	**5,390**	**5,150**	**5,087**	**5390**	**5150**	**5087**

Lessons Learned:

The study is still at the beginning stages so the conclusions are based on limited information. The results from the first year (2008-2009) were mixed due to some major die-off issues (up to 30% in one demonstration plot). However, there are some key items that we are seeing as we approach the end of the second year.

1. Salinity is a key determinant in the healthy establishment of the strawberry transplants

2. Row crop drip tape placement must be done correctly in order to micro-leach salts in the beds. This means that in the Oxnard Plain, growers may need to use 4 low flow tapes in order to successfully switch to the DOI or PSI protocols. Growers in Santa Maria might be able to use only 2 tapes per bed but the salinity must be evaluated in order to make sure the salts are not building up at the base of the plant. Using 3 tapes is not recommended on beds with 4 plant rows.

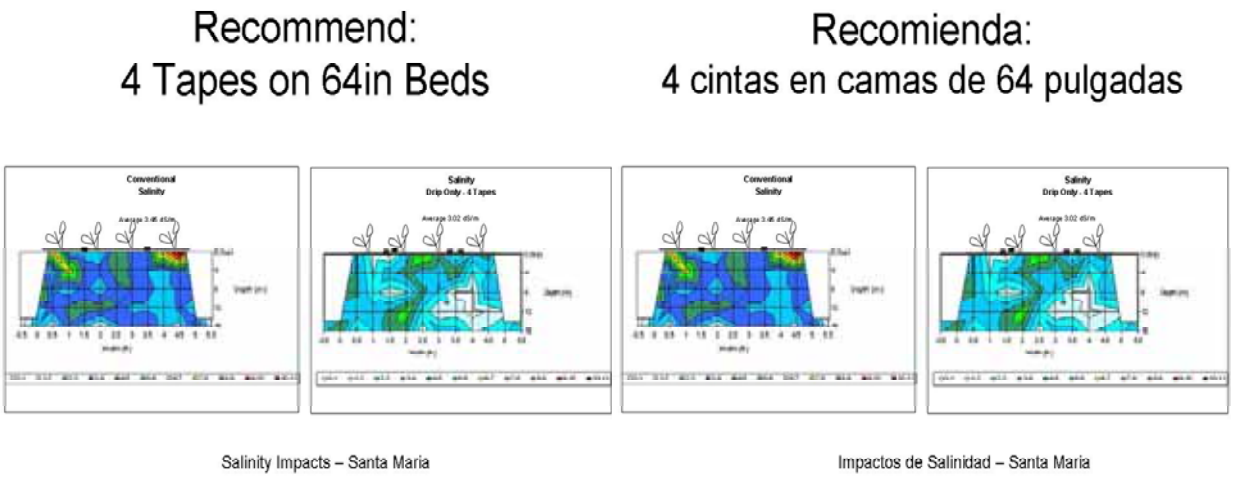


Figure 7. Sample of salinity contour graph

3. Monitoring the salinity of the soil and the irrigation water will help growers switch from the conventional irrigation method to a new protocol.

4. The irrigation water is one of the key determinants of whether there may be a problem. If the water quality is 1.0 dS/m or less, the impact is minimal. If the salinity of the irrigation supply water is 1.2 dS/m, the grower could see a 10-25% yield impact. It should be noted that well water, surface water, and reclaimed water sources have changing salinity characteristics during the season.

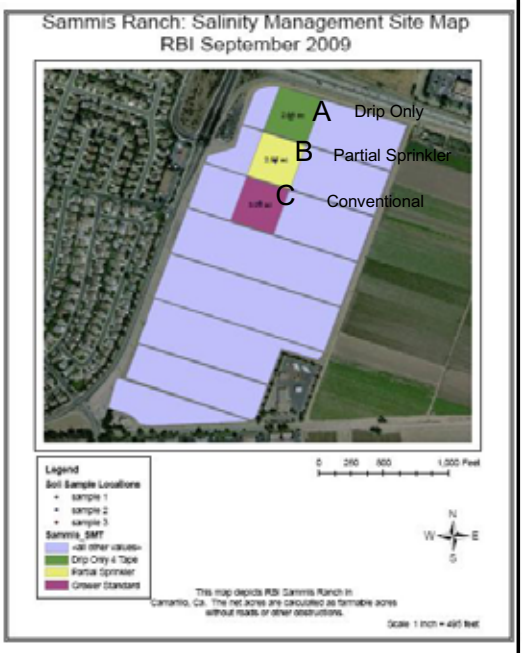
5. Salts come from various sources. Some sources of salt include the irrigation water, gypsum applications, fertilizers (both pre-plant and liquid), and composting (this seems to be a significant source).

6. Traditional salinity references have used the soil salinity as the key determinant for the salt impact on yields. The traditional approach states that if the soil salinity (ECe) approaches 4.0 dS/m the yield will be 100% impacted (i.e. – no yield). However, this research confirmed most growers in the Oxnard Plain routinely work in soils at 4-6 dS/m. with very little impact on yields. The reason is that they have been managing their salts properly.

7. Rain washes salts away from young transplants. The data clearly show that rain water (which is essentially salt-free) can push salts away from the plants. The graphs from all of the fields show rain represented by the black lines on the bottom of the graph. The data shows how dramatically the salinity level dropped after the rain.

8. The new protocols result in a yield increase up to 10%. The new protocols have also decreased the water use by over 10%. This research project has shown that the new approach has resulted in ***more crops per drop***.

Maps



Site 1: Sammis- Oxnard, CA

Site 3: Manzanita- Santa Maria, CA

III - 2.94 ac

C - 2.94 ac

B - 2.50 ac

II - 2.94 ac

I - 2.94 ac

Conventional

A - 2.01 ac

Partial Sprinkler

Site 2: Eclipse- Oxnard, CA

Water Use Data

2009-2010

Volumetric Data

Strawberry Salinity Management Project

Eclipse

Re-Plant date: 16 October 2009

Sammis

Plant Date: 11 October 2009

Drip Meter Readings

Date	C - Part Spr	I - Conv	A - Drip	B - Part Spr	C - Conv
10/3/2009	0.25	5.54	0.13	0.10	1.80
10/10/2009	0.25	5.54	0.19	0.15	1.82
10/17/2009	0.25	5.54	0.39	0.15	1.87
10/24/2009	0.25	5.54	0.62	0.35	1.95
10/31/2009	0.25	5.54	0.86	0.58	1.97
11/7/2009	0.33	5.63	1.12	0.82	2.03
11/14/2009	0.48	5.85	1.28	1.00	2.16
11/22/2009	0.59	5.92	1.57	1.26	2.40
11/28/2009	0.74	6.06	1.73	1.41	2.55
12/5/2009	0.90	6.17	1.87	1.59	2.69
12/13/2009	0.90	6.17	1.93	1.67	2.77
12/17/2009	0.90	6.17	1.99	1.69	2.79
1/9/2010	1.19	6.68	2.35	2.11	3.26
2/13/2010	1.54	6.96	2.74	2.48	3.62
3/6/2010	1.73	8.01	2.96	2.75	3.9
3/26/2010	2.25	8.62	3.42	3.26	4.35
4/10/2010	2.86	9.16	3.72	3.82	4.72
5/9/2010	4.03	10.23	4.43	4.57	5.37
5/23/2010	4.49	10.79	4.78	4.97	5.81
6/7/2010	4.97	11.31	5.31	5.51	6.34
7/2/2010			6.07	6.18	7
7/12/2010	5.57	12.08	6.2	6.28	7.19

Volume in AF

Date	C - Part Spr	I - Conv	A - Drip	B - Part Spr	C - Conv
10/3/2009	0.00	0.00	0.00	0.00	0.00
10/10/2009	0.00	0.00	0.06	0.05	0.02
10/17/2009	0.00	0.00	0.26	0.05	0.07
10/24/2009	0.00	0.00	0.49	0.25	0.15
10/31/2009	0.00	0.00	0.73	0.48	0.17
11/7/2009	0.08	0.09	0.99	0.72	0.23
11/14/2009	0.23	0.31	1.15	0.90	0.36
11/22/2009	0.34	0.38	1.44	1.16	0.60
11/28/2009	0.49	0.52	1.60	1.31	0.75
12/5/2009	0.65	0.63	1.74	1.49	0.89
12/13/2009	0.65	0.63	1.80	1.57	0.97
12/17/2009	0.65	0.63	1.86	1.59	0.99
1/9/2010	0.94	1.14	2.22	2.01	1.46
2/13/2010	1.29	1.42	2.61	2.38	1.82
3/6/2010	1.48	2.47	2.83	2.65	2.10
3/26/2010	2.00	3.08	3.29	3.16	2.55
4/10/2010	2.61	3.62	3.59	3.72	2.92
5/9/2010	3.78	4.69	4.30	4.47	3.57
5/23/2010	4.24	5.25	4.65	4.87	4.01
6/7/2010	4.72	5.77	5.18	5.41	4.54
7/2/2010			5.94	6.08	5.20
7/12/2010	5.32	6.54	6.07	6.18	5.39

Area

	2.90	2.90	2.98	2.97	3.03

Inches (applied per acre)

Date	C - Part Spr	I - Conv	A - Drip	B - Part Spr	C - Conv
10/3/2009	0.00	0.00	0.00	0.00	0.00
10/10/2009	0.00	0.00	0.24	0.20	0.08
10/17/2009	0.00	0.00	1.05	0.20	0.28
10/24/2009	0.00	0.00	1.97	1.01	0.59
10/31/2009	0.00	0.00	2.94	1.94	0.67
11/7/2009	0.33	0.37	3.99	2.91	0.91
11/14/2009	0.95	1.28	4.63	3.64	1.43
11/22/2009	1.41	1.57	5.80	4.69	2.38
11/28/2009	2.03	2.15	6.44	5.29	2.97
12/5/2009	2.69	2.61	7.01	6.02	3.52
12/13/2009	2.69	2.61	7.25	6.34	3.84
12/17/2009	2.69	2.61	7.49	6.42	3.92
1/9/2010	3.89	4.72	8.94	8.12	5.78
2/13/2010	5.34	5.88	10.51	9.62	7.21
3/6/2010	6.12	10.22	11.40	10.71	8.32
3/26/2010	8.28	12.74	13.25	12.77	10.10
4/10/2010	10.80	14.98	14.46	15.03	11.56
5/9/2010	15.64	19.41	17.32	18.06	14.14
5/23/2010	17.54	21.72	18.72	19.68	15.88
6/7/2010	19.53	23.88	20.86	21.86	17.98
7/2/2010			23.92	24.57	20.59
7/12/2010	22.01	27.06	24.44	24.97	21.35

Sprinkler Estimates

Minutes Operated

Date	C - Part Spr	I - Conv	A - Drip	B - Part Spr	C - Conv	
10/3/2009	0.00	0.00	0.00	0.00	0.00	
10/10/2009	0.00	0.00	0.00	0.00	0.00	
10/17/2009	180.00	180.00	0.00	290.00	420.00	est. by irrigator
10/24/2009	681.00	732.00	0.00	92.00	379.00	
10/31/2009	534.00	592.00	0.00	64.00	366.00	
11/7/2009	151.00	196.00	0.00	92.00	412.00	
11/14/2009	0.00	0.00	0.00	0.00	0.00	
11/22/2009	0.00	0.00	0.00	0.00	0.00	

	11/28/2009	0.00	0.00		0.00	0.00	0.00
	12/5/2009	0.00	0.00		0.00	0.00	0.00
	12/13/2009	0.00	0.00		0.00	0.00	0.00
	12/17/2009	0.00	0.00		0.00	0.00	0.00
	1/9/2010	0.00	0.00		0.00	0.00	0.00
	2/13/2010	0.00	0.00		0.00	0.00	0.00
	3/6/2010	0.00	0.00		0.00	0.00	0.00
	3/26/2010	0.00	0.00		0.00	0.00	0.00
	4/10/2010	0.00	0.00		0.00	0.00	0.00
	5/9/2010	0.00	0.00		0.00	0.00	0.00
	5/23/2010	0.00	0.00		0.00	0.00	0.00
	6/7/2010	0.00	0.00		0.00	0.00	0.00
	7/2/2010	0.00	0.00		0.00	0.00	0.00
	7/12/2010	0.00	0.00		0.00	0.00	0.00
Total Sprinkler Inches	Date	C - Part Spr	I - Conv		A - Drip	B - Part Spr	C - Conv
	10/3/2009	0.00	0.00		0.00	0.00	0.00
	10/10/2009	0.00	0.00		0.00	0.00	0.00
	10/17/2009	0.83	0.83		0.00	1.33	1.93
	10/24/2009	3.95	4.18		0.00	1.75	3.66
	10/31/2009	6.40	6.90		0.00	2.05	5.34
	11/7/2009	7.09	7.80		0.00	2.47	7.23
	11/14/2009	7.09	7.80		0.00	2.47	7.23
	11/22/2009	7.09	7.80		0.00	2.47	7.23
	11/28/2009	7.09	7.80		0.00	2.47	7.23
	12/5/2009	7.09	7.80		0.00	2.47	7.23
	12/13/2009	7.09	7.80		0.00	2.47	7.23
	12/17/2009	7.09	7.80		0.00	2.47	7.23
	1/9/2010	7.09	7.80		0.00	2.47	7.23
	2/13/2010	7.09	7.80		0.00	2.47	7.23
	3/6/2010	7.09	7.80		0.00	2.47	7.23
	3/26/2010	7.09	7.80		0.00	2.47	7.23
	4/10/2010	7.09	7.80		0.00	2.47	7.23
	5/9/2010	7.09	7.80		0.00	2.47	7.23
	5/23/2010	7.09	7.80		0.00	2.47	7.23
	6/7/2010	7.09	7.80		0.00	2.47	7.23
	7/2/2010	7.09	7.80		0.00	2.47	7.23
	7/12/2010	7.09	7.80		0.00	2.47	7.23

Based on:
(Sum of Min)/60 * GPM (3 gpm) * 96.3
(spr area 30 ft x 35 ft)

Total Inches

Eclipse WAP	Date	C - Part Spr	I - Conv		A - Drip	B - Part Spr	C - Conv	Sammis WAP
0	10/3/2009	0.00	0.00		0.00	0.00	0.00	0
0	10/10/2009	0.00	0.00		0.24	0.20	0.08	0
0	10/17/2009	0.83	0.83		1.05	1.53	2.20	1
1	10/24/2009	3.95	4.18		1.97	2.76	4.26	2
2	10/31/2009	6.40	6.90		2.94	3.98	6.02	3
3	11/7/2009	7.42	8.17		3.99	5.38	8.14	4
4	11/14/2009	8.04	9.08		4.63	6.10	8.66	5
5	11/22/2009	8.50	9.37		5.80	7.15	9.61	6
6	11/28/2009	9.12	9.95		6.44	7.76	10.20	7
7	12/5/2009	9.78	10.40		7.01	8.49	10.76	8
8	12/13/2009	9.78	10.40		7.25	8.81	11.07	9
9	12/17/2009	9.78	10.40		7.49	8.89	11.15	10
12	1/9/2010	10.98	12.51		8.94	10.59	13.01	13
17	2/13/2010	12.43	13.67		10.51	12.08	14.44	18
20	3/6/2010	13.21	18.02		11.40	13.17	15.55	21
23	3/26/2010	15.37	20.54		13.25	15.23	17.33	24
25	4/10/2010	17.89	22.78		14.46	17.50	18.80	26
28	5/9/2010	22.73	27.20		17.32	20.53	21.37	29
30	5/23/2010	24.63	29.52		18.72	22.14	23.11	31
32	6/7/2010	26.62	31.67		20.86	24.33	25.21	33
35	**7/2/2010**				23.92	27.03	27.83	36
36	**7/12/2010**	**29.10**	**34.86**		**24.44**	**27.44**	**28.58**	37
		-16.5%			**-14.5%**	**-4.0%**		

Volumetric Data

Strawberry Salinity Management Project

Manzanita

Plant Date: 10 November 2009

Drip Meter Readings

Date	I - Drip	II - Drip	A - Conv	B - Conv
11/22/2009	0.02	0.03	0.00	0.00
11/28/2009	0.08	0.08	0.00	0.00
12/5/2009	0.13	0.13	0.02	0.02
12/16/2009	0.13	0.13	0.02	0.02
1/9/2010	0.239	0.233	0.106	0.104
1/30/2010	0.264	0.257	0.13	0.127
2/13/2010	0.277	0.271	0.143	0.139
3/6/2010	0.33	0.319	0.196	0.192
3/26/2010	0.463	0.443	0.316	0.326
4/10/2010	0.611	0.583	0.49	0.478
5/9/2010	0.788	0.76	0.669	0.642
5/23/2010	0.935	0.899	0.827	0.806
6/7/2010	1.115	1.065	1.002	1.003
7/2/2010	1.422	1.386	1.313	1.314

Volume in AF

Date	I - Drip	II - Drip	A - Conv	B - Conv
11/22/2009	0.00	0.00	0.00	0.00
11/28/2009	0.06	0.06	0.00	0.00
12/5/2009	0.10	0.10	0.02	0.02
12/16/2009	0.10	0.10	0.02	0.02
1/9/2010	0.22	0.21	0.10	0.10
1/30/2010	0.24	0.23	0.13	0.13
2/13/2010	0.25	0.25	0.14	0.14
3/6/2010	0.31	0.29	0.19	0.19
3/26/2010	0.44	0.42	0.31	0.32
4/10/2010	0.59	0.56	0.49	0.48
5/9/2010	0.76	0.74	0.67	0.64
5/23/2010	0.91	0.87	0.83	0.80
6/7/2010	1.09	1.04	1.00	1.00
7/2/2010	1.40	1.36	1.31	1.31

Area

	I - Drip	II - Drip	A - Conv	B - Conv
	2.22	2.22	2.22	2.22

Inches (applied per acre)

Date	I - Drip	II - Drip	A - Conv	B - Conv
11/22/2009	0.00	0.00	0.00	0.00
11/28/2009	0.32	0.30	0.00	0.00
12/5/2009	0.56	0.56	0.11	0.11
12/16/2009	0.56	0.56	0.11	0.11
1/9/2010	1.16	1.12	0.56	0.55
1/30/2010	1.43	1.39	0.70	0.69
2/13/2010	1.37	1.33	0.76	0.74
3/6/2010	1.65	1.59	1.05	1.03
3/26/2010	2.50	2.39	1.71	1.76
4/10/2010	3.30	3.15	2.65	2.58
5/9/2010	4.13	3.97	3.61	3.46
5/23/2010	4.92	4.72	4.46	4.35
6/7/2010	5.90	5.62	5.41	5.41
7/2/2010	7.56	7.36	7.09	7.09

Sprinkler Estimates

Minutes Operated

Date	I - Drip	II - Drip	A - Conv	B - Conv
11/22/2009	210.00	210.00	0.00	0.00
11/28/2009	0.00	0.00	570.00	575.00
12/5/2009	0.00	0.00	0.00	0.00
12/16/2009	0.00	0.00	0.00	0.00
1/9/2010	0.00	0.00	0.00	0.00
1/30/2010	0.00	0.00	0.00	0.00
2/13/2010	0.00	0.00	0.00	0.00
3/6/2010	0.00	0.00	0.00	0.00
3/26/2010	0.00	0.00	0.00	0.00
4/10/2010	0.00	0.00	0.00	0.00
5/9/2010	0.00	0.00	0.00	0.00
5/23/2010	0.00	0.00	0.00	0.00
6/7/2010	0.00	0.00	0.00	0.00
7/2/2010	0.00	0.00	0.00	0.00

est.

Total Sprinkler Inches

Date	I - Drip	II - Drip	A - Conv	B - Conv
11/22/2009	0.96	0.96	0.00	0.00
11/28/2009	0.96	0.96	2.61	2.69
12/5/2009	0.96	0.96	2.61	2.64
12/16/2009	0.96	0.96	2.61	2.64
1/9/2010	0.96	0.96	2.61	2.64
1/30/2010	0.96	0.96	2.61	2.64
2/13/2010	0.96	0.96	2.61	2.64
3/6/2010	0.96	0.96	2.61	2.64
3/26/2010	0.96	0.96	2.61	2.64
4/10/2010	0.96	0.96	2.61	2.64
5/9/2010	0.96	0.96	2.61	2.64
5/23/2010	0.96	0.96	2.61	2.64
6/7/2010	0.96	0.96	2.61	2.64
7/2/2010	0.96	0.96	2.61	2.64

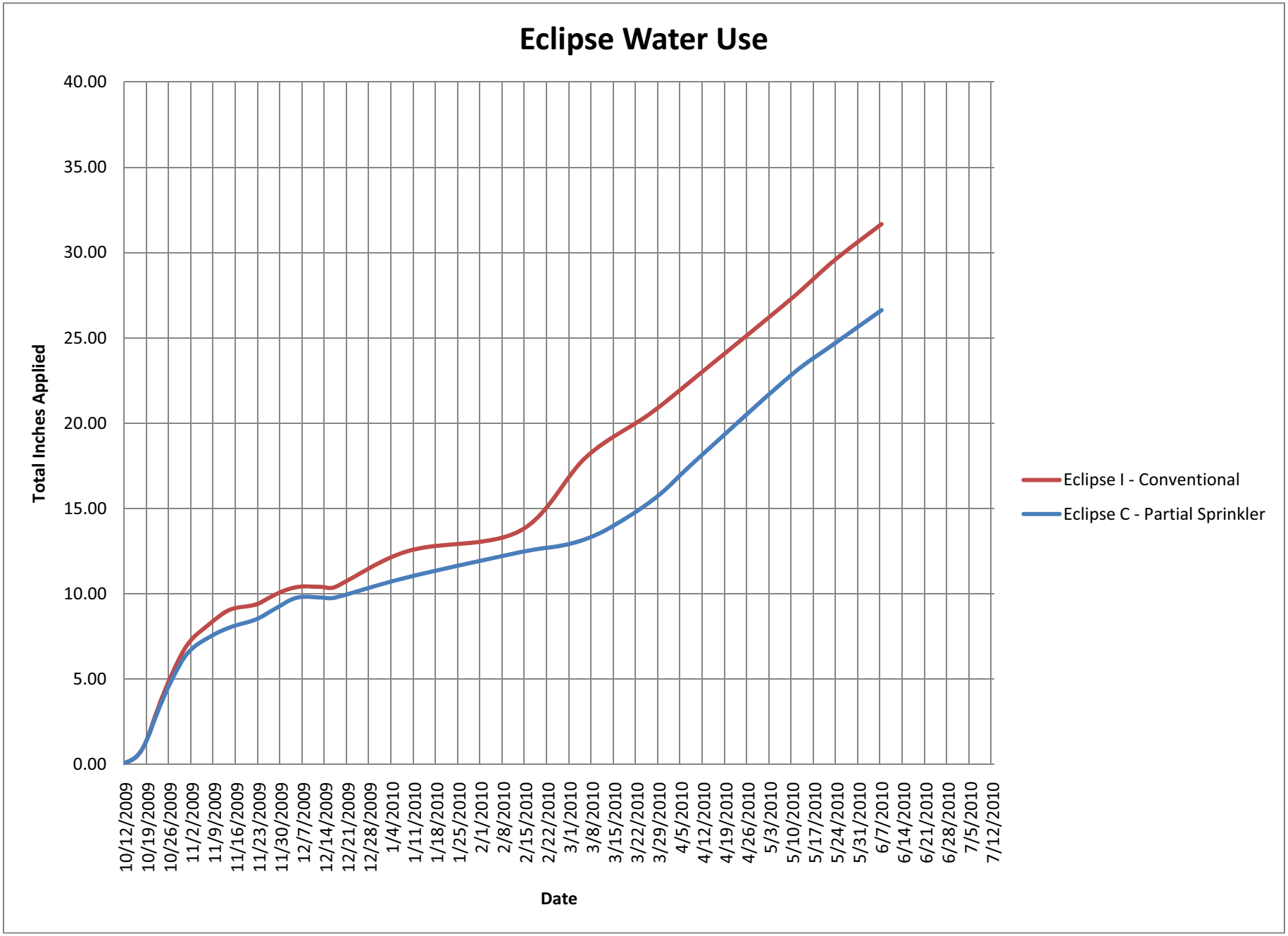
Based on:
(Sum of Min)/60 * GPM (3 gpm) * 96.3
(spr area 30 ft x 35 ft)

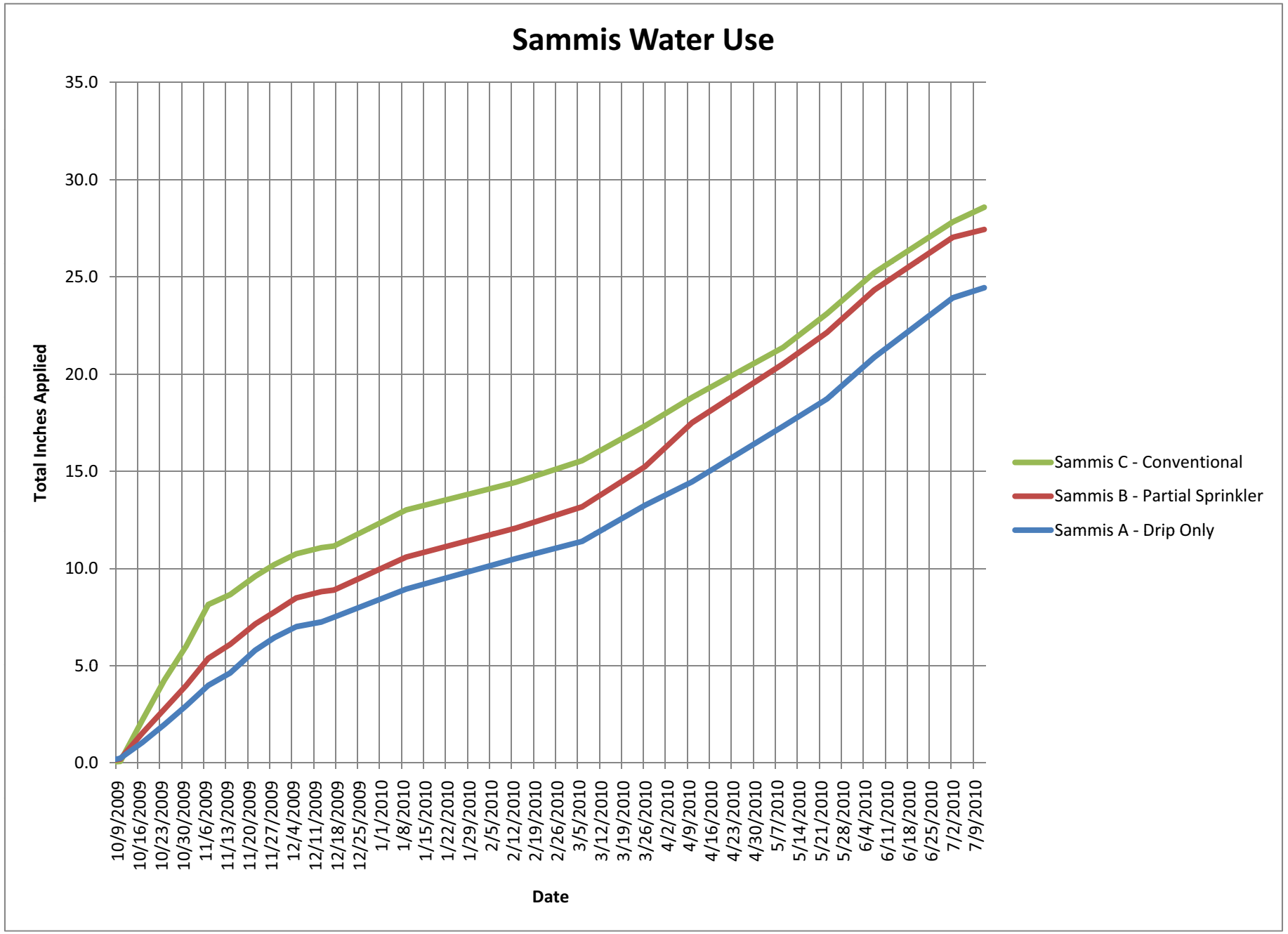
Total Inches

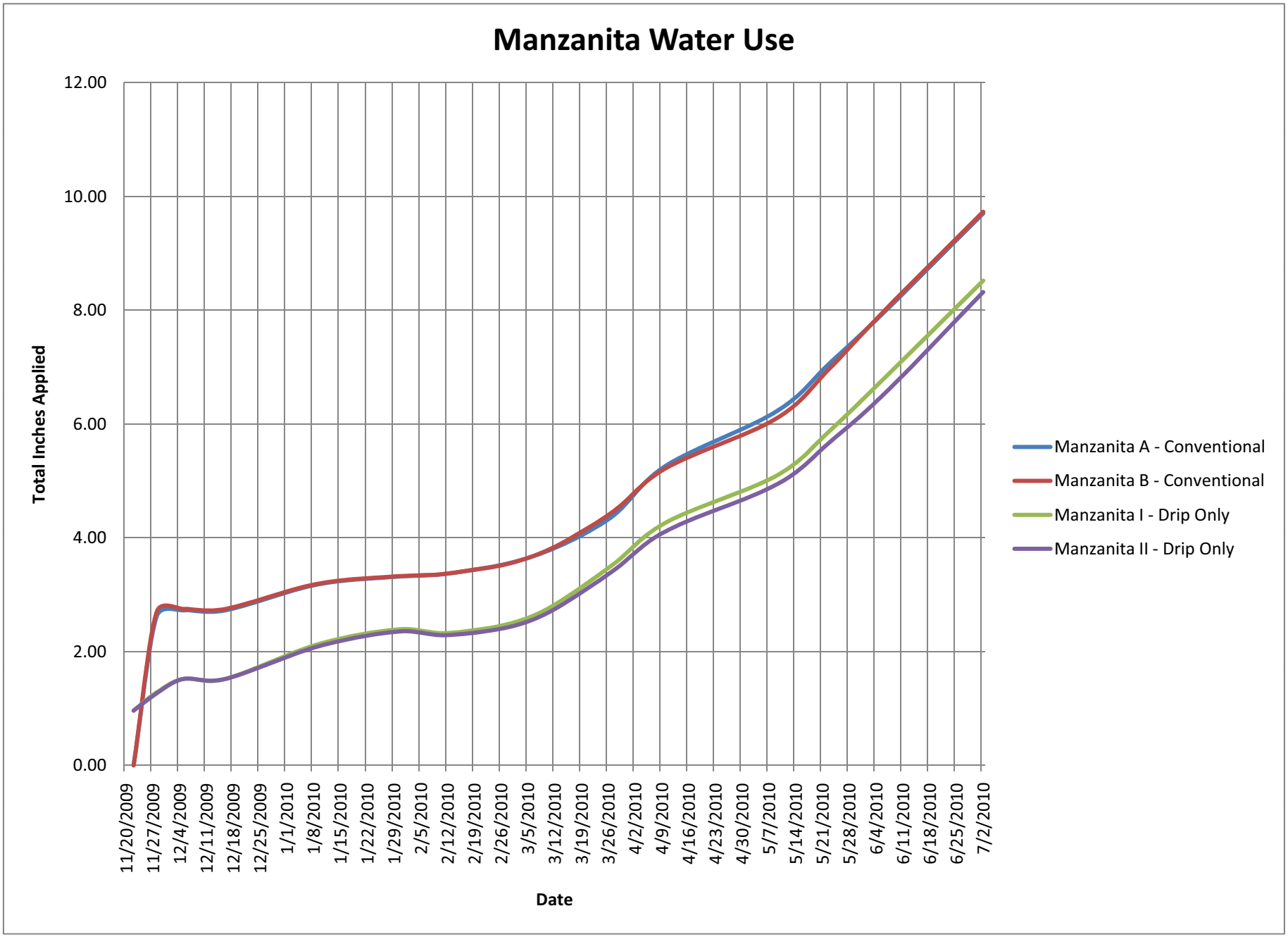
Date	I - Drip	II - Drip	A - Conv	B - Conv	Manzanita WAP
11/22/2009	0.96	0.96	0.00	0.00	2
11/28/2009	1.28	1.27	2.61	2.69	3
12/5/2009	1.52	1.52	2.73	2.75	4
12/16/2009	1.52	1.52	2.73	2.75	5
1/9/2010	2.13	2.09	3.18	3.19	9
1/30/2010	2.39	2.35	3.32	3.32	12
2/13/2010	2.33	2.29	3.38	3.38	14
3/6/2010	2.62	2.55	3.67	3.67	17
3/26/2010	3.47	3.36	4.32	4.40	20
4/10/2010	4.27	4.11	5.26	5.22	23
5/9/2010	5.09	4.94	6.22	6.10	25
5/23/2010	5.89	5.69	7.08	6.99	27
6/7/2010	6.86	6.58	8.02	8.05	30
7/2/2010	**8.52**	**8.32**	**9.70**	**9.73**	33

-13.4%

From: (Drip Avg-Conv Avg)/Conv Avg


Eclipse Water Use
Total Inches Applied
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
10/12/2009
10/19/2009
10/26/2009
11/2/2009
11/9/2009
11/16/2009
11/23/2009
11/30/2009
12/7/2009
12/14/2009
12/21/2009
12/28/2009
1/4/2010
1/11/2010
1/18/2010
1/25/2010
2/1/2010
2/8/2010
2/15/2010
2/22/2010
3/1/2010
3/8/2010
3/15/2010
3/22/2010
3/29/2010
4/5/2010
4/12/2010
4/19/2010
4/26/2010
5/3/2010
5/10/2010
5/17/2010
5/24/2010
5/31/2010
6/7/2010
6/14/2010
6/21/2010
6/28/2010
7/5/2010
7/12/2010
Date
Eclipse I - Conventional
Eclipse C - Partial Sprinkler


Sammis Water Use
Total Inches Applied
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
10/9/2009
10/16/2009
10/23/2009
10/30/2009
11/6/2009
11/13/2009
11/20/2009
11/27/2009
12/4/2009
12/11/2009
12/18/2009
12/25/2009
1/1/2010
1/8/2010
1/15/2010
1/22/2010
1/29/2010
2/5/2010
2/12/2010
2/19/2010
2/26/2010
3/5/2010
3/12/2010
3/19/2010
3/26/2010
4/2/2010
4/9/2010
4/16/2010
4/23/2010
4/30/2010
5/7/2010
5/14/2010
5/21/2010
5/28/2010
6/4/2010
6/11/2010
6/18/2010
6/25/2010
7/2/2010
7/9/2010
Date
Sammis C - Conventional
Sammis B - Partial Sprinkler
Sammis A - Drip Only


Manzanita Water Use
Total Inches Applied
12.00
10.00
8.00
6.00
4.00
2.00
0.00
11/20/2009
11/27/2009
12/4/2009
12/11/2009
12/18/2009
12/25/2009
1/1/2010
1/8/2010
1/15/2010
1/22/2010
1/29/2010
2/5/2010
2/12/2010
2/19/2010
2/26/2010
3/5/2010
3/12/2010
3/19/2010
3/26/2010
4/2/2010
4/9/2010
4/16/2010
4/23/2010
4/30/2010
5/7/2010
5/14/2010
5/21/2010
5/28/2010
6/4/2010
6/11/2010
6/18/2010
6/25/2010
7/2/2010
Date
Manzanita A - Conventional
Manzanita B - Conventional
Manzanita I - Drip Only
Manzanita II - Drip Only

Sammis:

Photos and Soil Water Salinity

Sammis - Block A

Drip Only

10/17/2009 – 8 DAP

10/24/2009 – 15 DAP

10/31/2009 – 22 DAP

11/07/2009 – 29 DAP

Sammis - Block A

Drip Only

11/14/2009 – 36 DAP

11/22/2009 – 44 DAP

11/28/2009 – 50 DAP

12/05/2009 – 57 DAP

Sammis - Block A

Drip Only

12/13/2009 – 65 DAP

12/17/2009 – 69 DAP

01/09/2010 – 92 DAP

01/23/2010 – 106 DAP

Sammis - Block A

Drip Only

02/13/2010 – 127 DAP

03/06/2010 – 148 DAP

03/26/2010 – 168 DAP

04/10/2010 – 183 DAP

Sammis - Block A

Drip Only

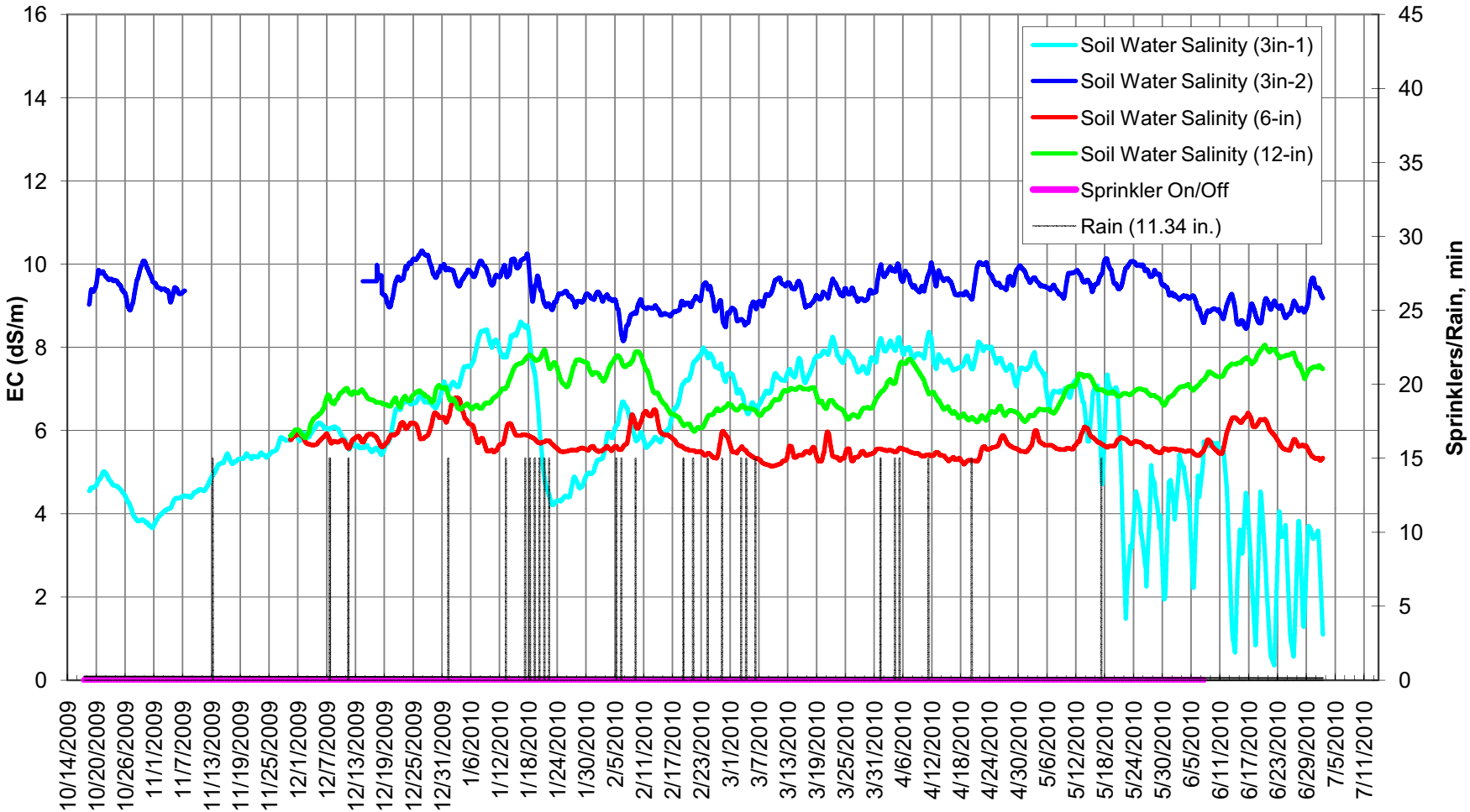
05/09/2010 – 212 DAP

06/07/2010 – 241 DAP

07/02/2010 – 266 DAP

Sammis Block A - Drip Only

Plant Date 11 October 2009



Sammis - Block B

Partial Sprinkler

10/17/2009 – 8 DAP

10/24/2009 – 15 DAP

10/31/2009 – 22 DAP

11/07/2009 – 29 DAP

Sammis - Block B

Partial Sprinkler

11/14/2009 – 36 DAP

11/22/2009 – 44 DAP

11/28/2009 – 50 DAP

12/05/2009 – 57 DAP

Sammis - Block B

Partial Sprinkler

12/13/2009 – 65 DAP

12/17/2009 – 69 DAP

01/09/2010 – 92 DAP

01/30/2010 – 106 DAP

Sammis - Block B

Partial Sprinkler

02/13/2010 – 127 DAP

03/06/2010 – 148 DAP

03/26/2010 – 168 DAP

04/10/2010 – 183 DAP

Sammis - Block B

Partial Sprinkler

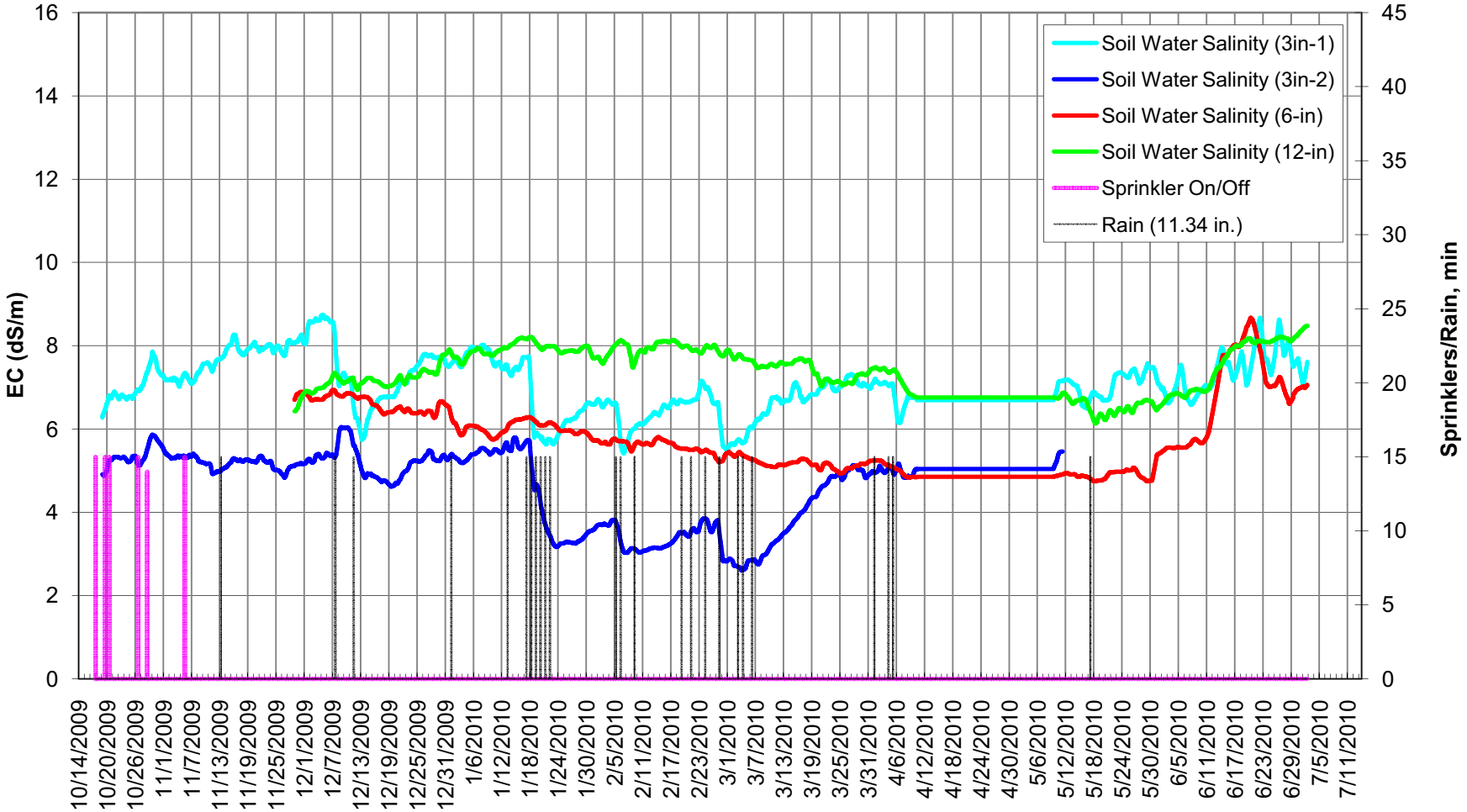
05/09/2010 – 212 DAP

06/07/2010 – 241DAP

07/02/2010 – 266 DAP

Sammis Block B - Partial Sprinkler

Plant Date 11 October 2009



Sammis - Block C

Conventional

10/17/2009 – 8 DAP

10/24/2009 – 15 DAP

10/31/2009 – 22 DAP

11/07/2009 – 29 DAP

Sammis - Block C

Conventional

11/14/2009 – 36 DAP

11/22/2009 – 44 DAP

11/28/2009 – 50 DAP

12/05/2009 – 57 DAP

Sammis - Block C

Conventional

12/13/2009 – 65 DAP

12/17/2009 – 69 DAP

01/09/2010 – 92 DAP

01/30/2010 – 106DAP

Sammis - Block C

Conventional

02/13/2010 – 127 DAP

03/06/2010 – 148 DAP

3/26/2010 – 168 DAP

04/10/2010 – 183DAP

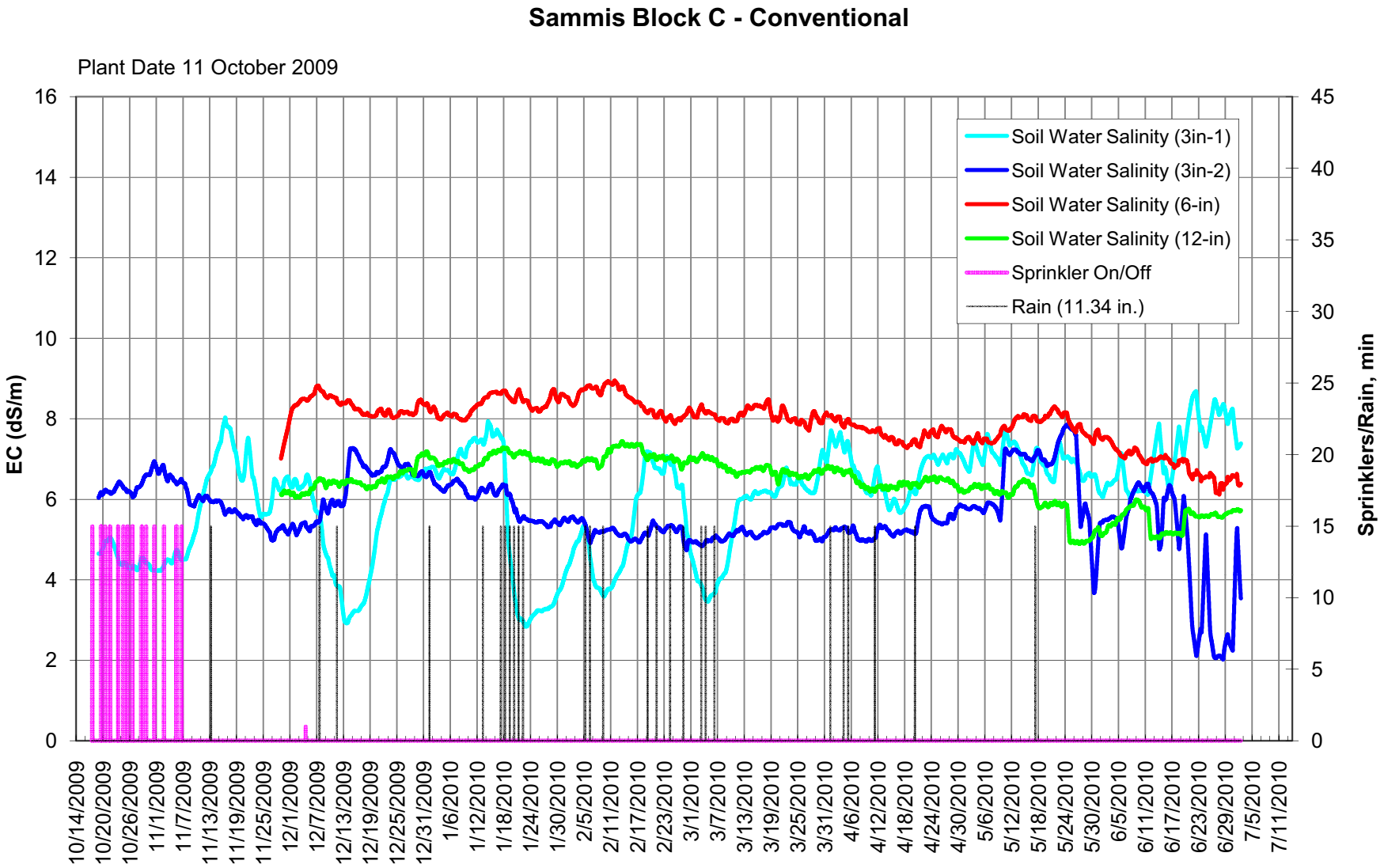
Sammis - Block C

Conventional

05/09/2010 – 212 DAP

06/07/2010 – 241 DAP

07/02/2010 – 266 DAP


Sammis Block C - Conventional
Plant Date 11 October 2009
EC (dS/m)
Sprinklers/Rain, min
Soil Water Salinity (3in-1)
Soil Water Salinity (3in-2)
Soil Water Salinity (6-in)
Soil Water Salinity (12-in)
Sprinkler On/Off
Rain (11.34 in.)
0
2
4
6
8
10
12
14
16
0
5
10
15
20
25
30
35
40
45
10/14/2009
10/20/2009
10/26/2009
11/1/2009
11/7/2009
11/13/2009
11/19/2009
11/25/2009
12/1/2009
12/7/2009
12/13/2009
12/19/2009
12/25/2009
12/31/2009
1/6/2010
1/12/2010
1/18/2010
1/24/2010
1/30/2010
2/5/2010
2/11/2010
2/17/2010
2/23/2010
3/1/2010
3/7/2010
3/13/2010
3/19/2010
3/25/2010
3/31/2010
4/6/2010
4/12/2010
4/18/2010
4/24/2010
4/30/2010
5/6/2010
5/12/2010
5/18/2010
5/24/2010
5/30/2010
6/5/2010
6/11/2010
6/17/2010
6/23/2010
6/29/2010
7/5/2010
7/11/2010

Eclipse:

Photos and Soil Water Salinity

Eclipse - Block C

Partial Sprinkler

10/17/2009 – 1 DAP

10/24/2009 – 8 DAP

10/31/2009 – 15 DAP

11/07/2009 – 22 DAP

Eclipse - Block C

Partial Sprinkler

11/14/2009 – 29 DAP

11/22/2009 – 37 DAP

11/28/2009 – 43 DAP

12/05/2009 – 50 DAP

Eclipse - Block C

Partial Sprinkler

12/13/2009 – 58 DAP

12/17/2009 – 62 DAP

01/09/2010 – 85 DAP

01/23/2010 – 99 DAP

Eclipse - Block C

Partial Sprinkler

02/13/2010 – 127 DAP

03/06/2010 – 148 DAP

03/26/2010 – 168 DAP

04/10/2010– 183DAP

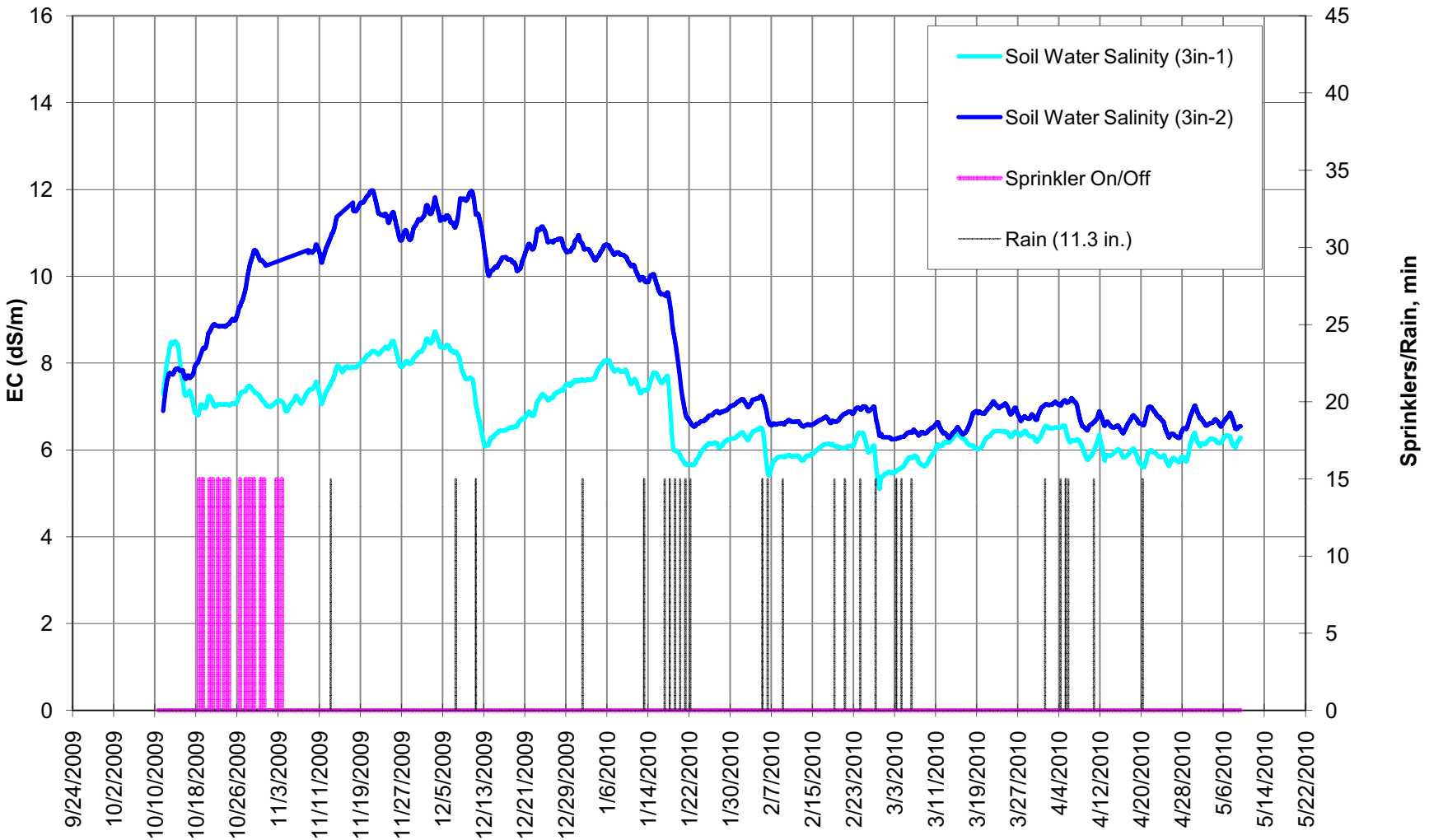
Eclipse - Block C

Partial Sprinkler

5/09/2010 – 212 DAP

Eclipse C

Plant Date 16 October 2009



Eclipse - Block I

Conventional

10/17/2009 – 1 DAP

10/24/2009 – 8 DAP

10/31/2009 – 15 DAP

11/07/2009 – 22 DAP

Eclipse - Block I

Conventional

11/14/2009 – 29 DAP

11/22/2009 – 37 DAP

11/28/2009 – 43 DAP

12/05/2009 – 50 DAP

Eclipse - Block I

Conventional

12/13/2009 – 58 DAP

12/17/2009 – 69 DAP

01/09/2010 – 92 DAP

01/23/10 – 106 DAP

Eclipse - Block I

Conventional

02/13/2010 – 127 DAP

03/06/2010 – 148 DAP

03/26/2010 – 168 DAP

04/10/2010 – 183 DAP

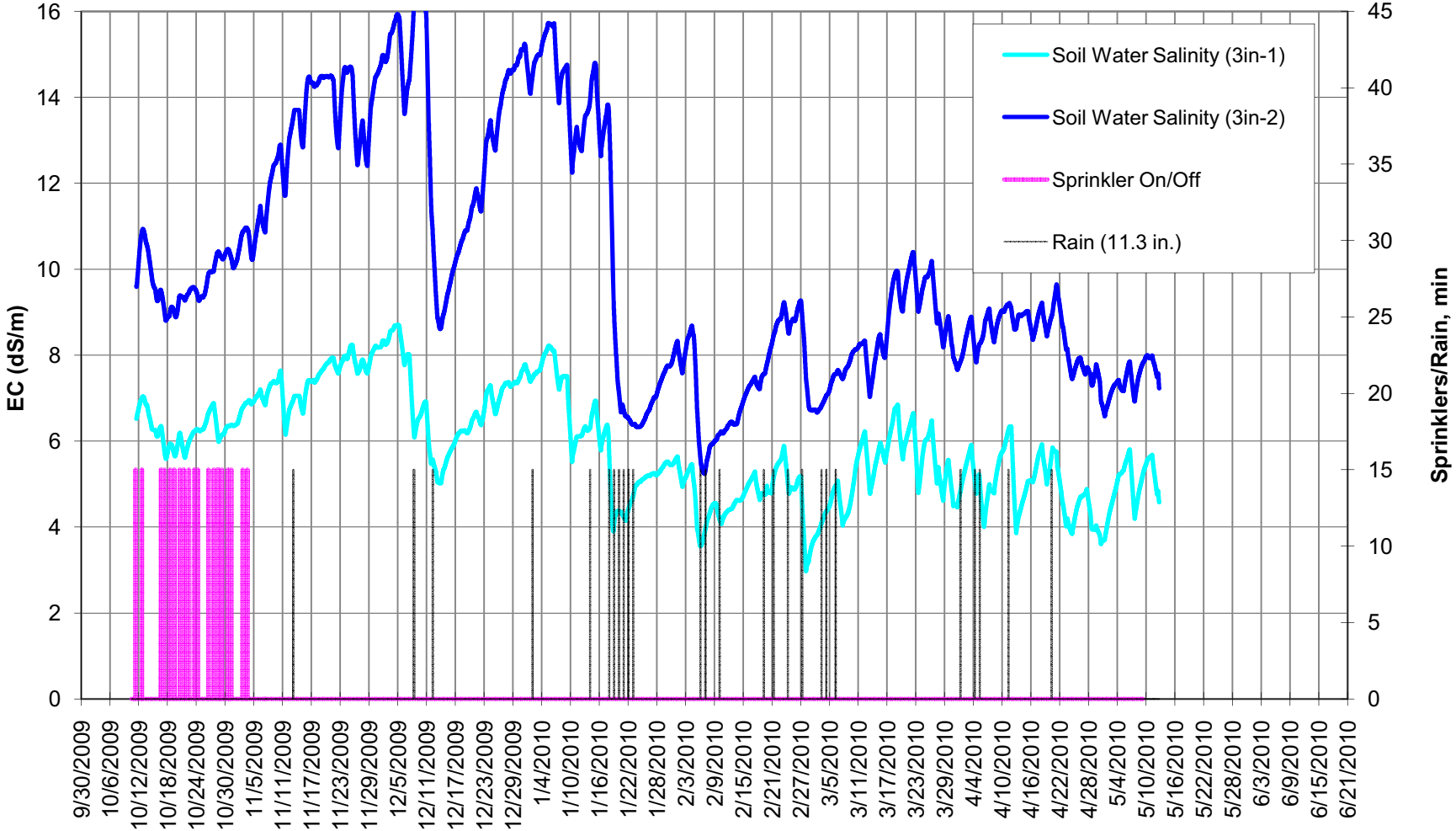
Eclipse - Block I

Conventional

04/10/2010 – 212 DAP

Eclipse I

Plant Date 16 October 2009



Manzanita:

Photos and Soil Water Salinity

Manzanita - Block A

Conventional

11/22/2009 – 10 DAP

11/28/2009 – 16 DAP

12/05/2009 – 23 DAP

12/16/2009 – 33 DAP

Manzanita - Block A

Conventional

01/09/2010 - 57 DAP

01/30/2010 - 78DAP

02/13/2010 - 92 DAP

03/06/2010 - 113 DAP

Manzanita - Block A

Conventional

03/26/2010 - 133 DAP

04/10/2010 - 148 DAP

05/09/2010 - 177 DAP

06/07/2010 - 206 DAP

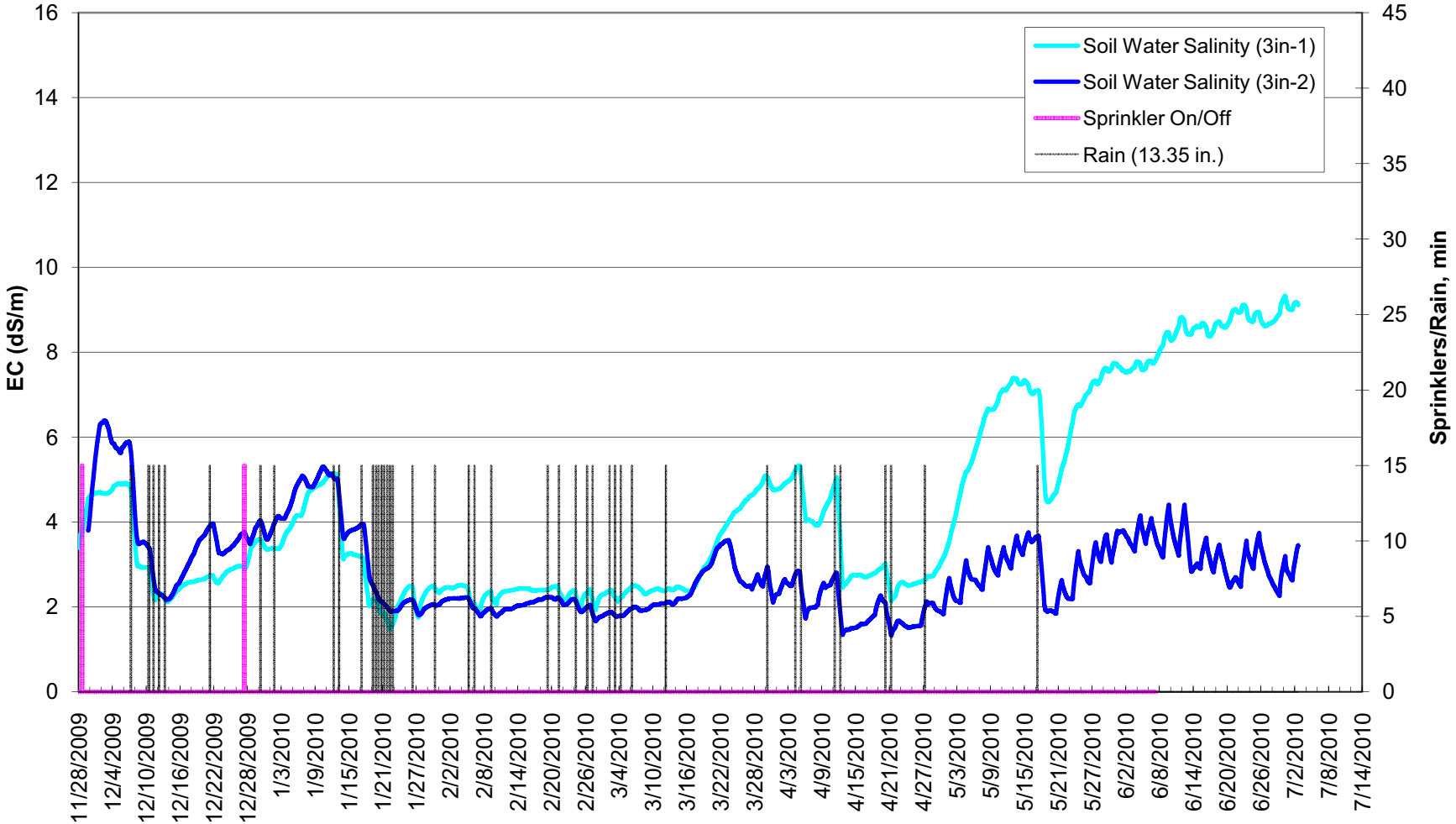
Manzanita - Block A

07/02/2010 - 231 DAP

Conventional

Manzanita A - Conventional

Plant Date 10 November 2009



Manzanita - Block B

Conventional

11/22/2009 – 10 DAP

11/28/2009 – 16 DAP

12/05/2009 – 23 DAP

12/16/2009 – 33 DAP

Manzanita – Block B

Conventional

01/09/2010 – 57 DAP

01/30/2010 – 78 DAP

02/13/2010 – 92 DAP

03/06/2010 – 113 DAP

Manzanita – Block B

Conventional

03/26/2010 – 133 DAP

04/10/2010 – 148DAP

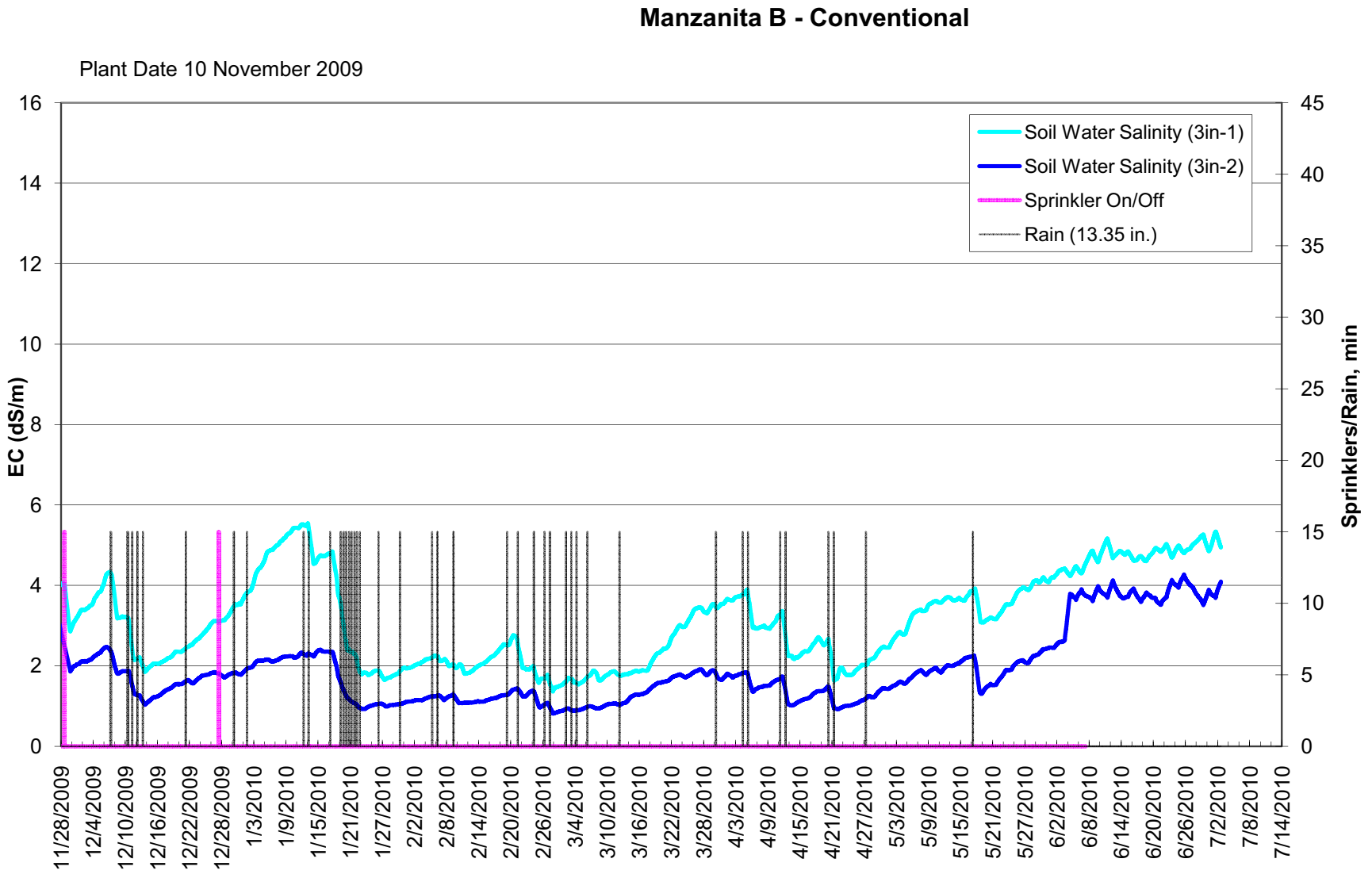
05/09/2010 – 177 DAP

06/07/2010 – 206 DAP

Manzanita – Block B

Conventional

07/02/2010 – 231 DAP


Manzanita B - Conventional
Plant Date 10 November 2009
Soil Water Salinity (3in-1)
Soil Water Salinity (3in-2)
Sprinkler On/Off
Rain (13.35 in.)
EC (dS/m)
Sprinklers/Rain, min
0
2
4
6
8
10
12
14
16
0
5
10
15
20
25
30
35
40
45
11/28/2009
12/4/2009
12/10/2009
12/16/2009
12/22/2009
12/28/2009
1/3/2010
1/9/2010
1/15/2010
1/21/2010
1/27/2010
2/2/2010
2/8/2010
2/14/2010
2/20/2010
2/26/2010
3/4/2010
3/10/2010
3/16/2010
3/22/2010
3/28/2010
4/3/2010
4/9/2010
4/15/2010
4/21/2010
4/27/2010
5/3/2010
5/9/2010
5/15/2010
5/21/2010
5/27/2010
6/2/2010
6/8/2010
6/14/2010
6/20/2010
6/26/2010
7/2/2010
7/8/2010
7/14/2010

Manzanita - Block I

Drip Only

11/22/2009 – 10 DAP

11/28/2009 – 16 DAP

12/05/2009 – 23 DAP

12/16/2009 – 33 DAP

Manzanita – Block I

Drip Only

01/09/2010 – 57 DAP

01/30/2010 – 78 DAP

02/13/2010 – 92 DAP

03/06/2010 – 113 DAP

Manzanita – Block I

Drip Only

03/26/2010 – 133 DAP

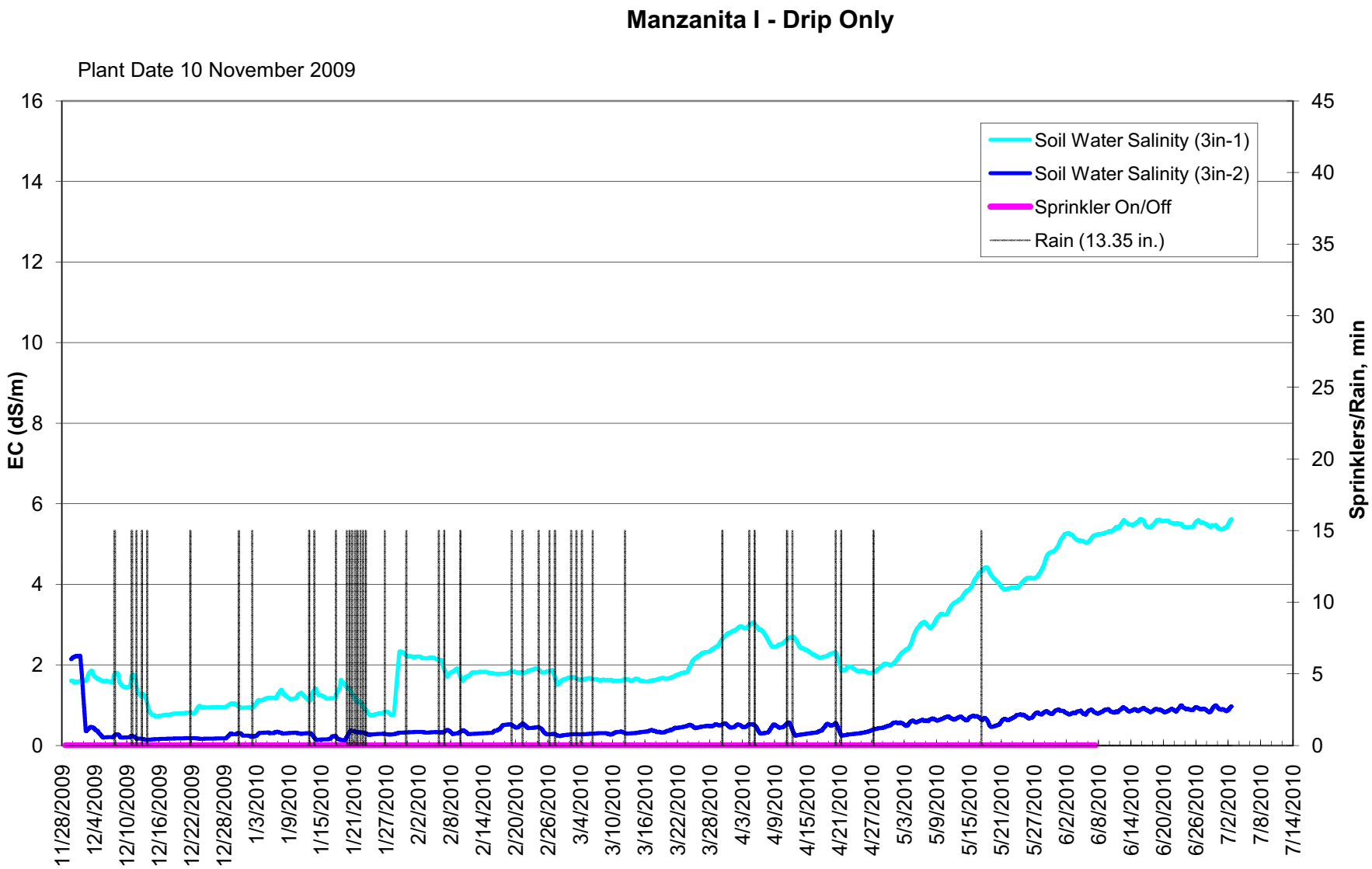
04/10/2010 – 148 DAP

05/09/2010 – 177 DAP

06/07/2010 – 206 DAP

Manzanita – Block I

07/02/2010 – 231 DAP **Drip Only**


Manzanita I - Drip Only
Plant Date 10 November 2009
EC (dS/m)
Sprinklers/Rain, min
Soil Water Salinity (3in-1)
Soil Water Salinity (3in-2)
Sprinkler On/Off
Rain (13.35 in.)
0
2
4
6
8
10
12
14
16
0
5
10
15
20
25
30
35
40
45
11/28/2009
12/4/2009
12/10/2009
12/16/2009
12/22/2009
12/28/2009
1/3/2010
1/9/2010
1/15/2010
1/21/2010
1/27/2010
2/2/2010
2/8/2010
2/14/2010
2/20/2010
2/26/2010
3/4/2010
3/10/2010
3/16/2010
3/22/2010
3/28/2010
4/3/2010
4/9/2010
4/15/2010
4/21/2010
4/27/2010
5/3/2010
5/9/2010
5/15/2010
5/21/2010
5/27/2010
6/2/2010
6/8/2010
6/14/2010
6/20/2010
6/26/2010
7/2/2010
7/8/2010
7/14/2010

Manzanita - Block II

Drip Only

11/22/2009 – 10 DAP

11/28/2009 – 16 DAP

12/05/2009 – 23 DAP

12/16/2009 – 33 DAP

Manzanita – Block II

Drip Only

01/09/2010 – 57 DAP

01/30/2010 – 78 DAP

02/13/2010 – 92 DAP

03/06/2010 – 113 DAP

Manzanita – Block II

Drip Only

03/26/2010 – 133 DAP

04/10/2010 – 148 DAP

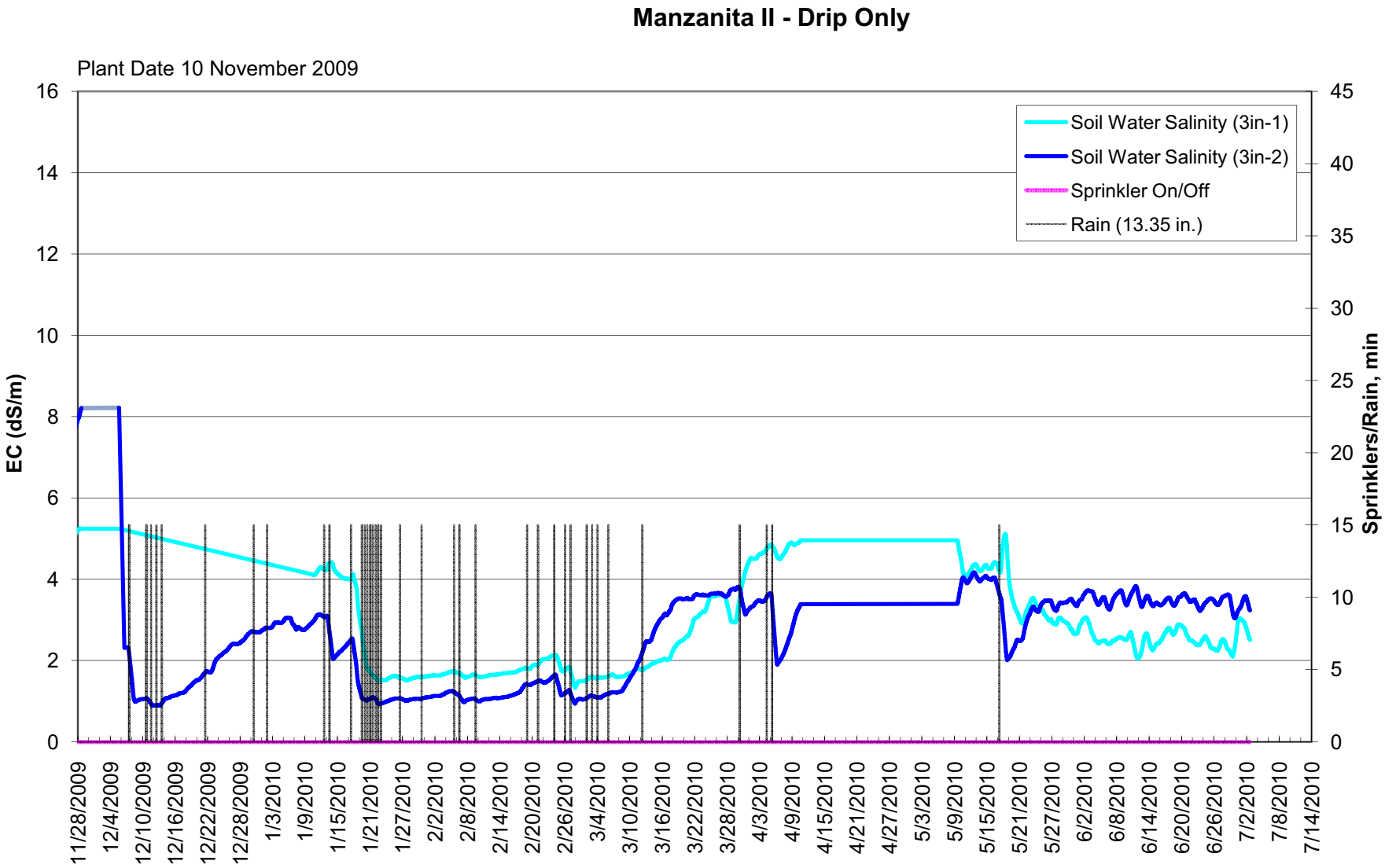
05/09/2010 – 177 DAP

06/07/2010 – 206 DAP

Manzanita – Block II

07/02/2010 – 231 DAP

Drip Only


Manzanita II - Drip Only
Plant Date 10 November 2009
EC (dS/m)
Sprinklers/Rain, min
Soil Water Salinity (3in-1)
Soil Water Salinity (3in-2)
Sprinkler On/Off
Rain (13.35 in.)
0
2
4
6
8
10
12
14
16
0
5
10
15
20
25
30
35
40
45
11/28/2009
12/4/2009
12/10/2009
12/16/2009
12/22/2009
12/28/2009
1/3/2010
1/9/2010
1/15/2010
1/21/2010
1/27/2010
2/2/2010
2/8/2010
2/14/2010
2/20/2010
2/26/2010
3/4/2010
3/10/2010
3/16/2010
3/22/2010
3/28/2010
4/3/2010
4/9/2010
4/15/2010
4/21/2010
4/27/2010
5/3/2010
5/9/2010
5/15/2010
5/21/2010
5/27/2010
6/2/2010
6/8/2010
6/14/2010
6/20/2010
6/26/2010
7/2/2010
7/8/2010
7/14/2010

Sammis:

Detailed Salinity Data

Evaluation of Modified Drip Irrigation Strategies on Strawberries - Sammis Blocks

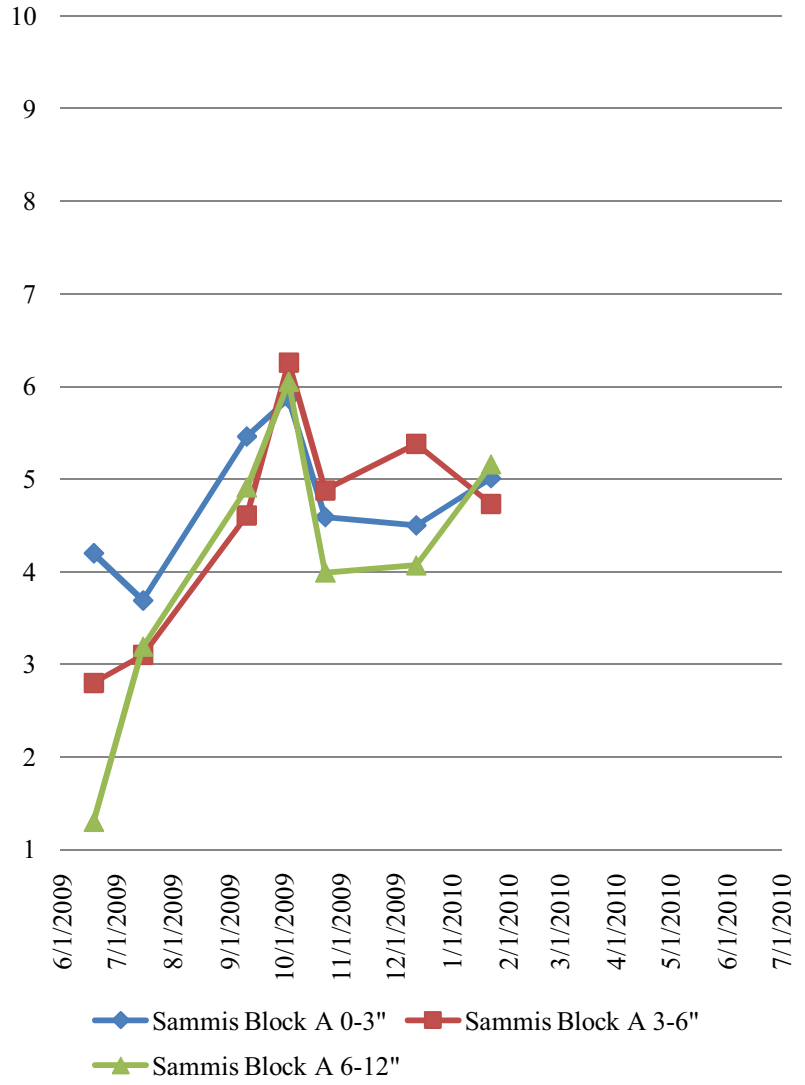
Date:		6/19/2009			7/16/2009			9/11/2009			10/4/2009			10/24/2009			12/13/2009			1/23/2010			6/7/2010		
		Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)
Block A	3"	DP	4.20	-	DP	3.69	301.35	DP	5.46	570.50	DP	5.87	476.00	DP	4.59	236.25	DP	4.50	158.90	DP	5.01	244.30	DP		
	6"	DP	2.80	-	DP	3.10	318.85	DP	4.61	288.75	DP	6.26	371.00	DP	4.88	119.00	DP	5.38	133.00	DP	4.73	153.30	DP		
	12"	DP	1.30	-	DP	3.19	360.50	DP	4.91	381.50	DP	6.05	199.50	DP	3.99	114.80	DP	4.07	164.50	DP	5.16	169.40	DP		
Block B	3"	DLS	-	-	DLS	2.96	260.40	DLS	4.06	287.00	DLS	5.18	441.00	DLS	4.92	311.50	DLS	6.03	211.75	DLS	4.25	143.50	DLS		
	6"	DLS	-	-	DLS	2.59	306.25	DLS	4.19	288.75	DLS	7.75	341.25	DLS	7.64	253.75	DLS	4.52	141.75	DLS	4.53	121.10	DLS		
	12"	DLS	-	-	DLS	2.78	298.90	DLS	4.14	220.50	DLS	4.94	225.75	DLS	4.76	185.50	DLS	8.12	168.00	DLS	4.10	87.50	DLS		
Block C	3"	DLS	2.80	-	DLS	3.65	223.65	DLS	4.02	262.50	DLS	5.28	476.00	DLS	6.62	791.00	DLS	5.93	378.00	DLS	5.19	303.80	DLS		
	6"	DLS	2.50	-	DLS	3.98	328.65	DLS	3.52	199.50	DLS	10.10	395.50	DLS	9.88	553.00	DLS	4.83	206.50	DLS	7.41	128.10	DLS		
	12"	DLS	2.00	-	DLS	2.82	253.05	DLS	3.53	130.20	DLS	5.84	322.00	DLS	4.98	322.00	DLS	5.33	232.05	DLS	5.21	186.90	DLS		
Block D	3"				SSS	1.49	123.90				SSS	4.63	329.00												
	6"				SSS	2.55	298.20				SSS	5.28	371.00												
	12"				SSS	1.98	264.95				SSS	7.55	315.00												

Results Pending

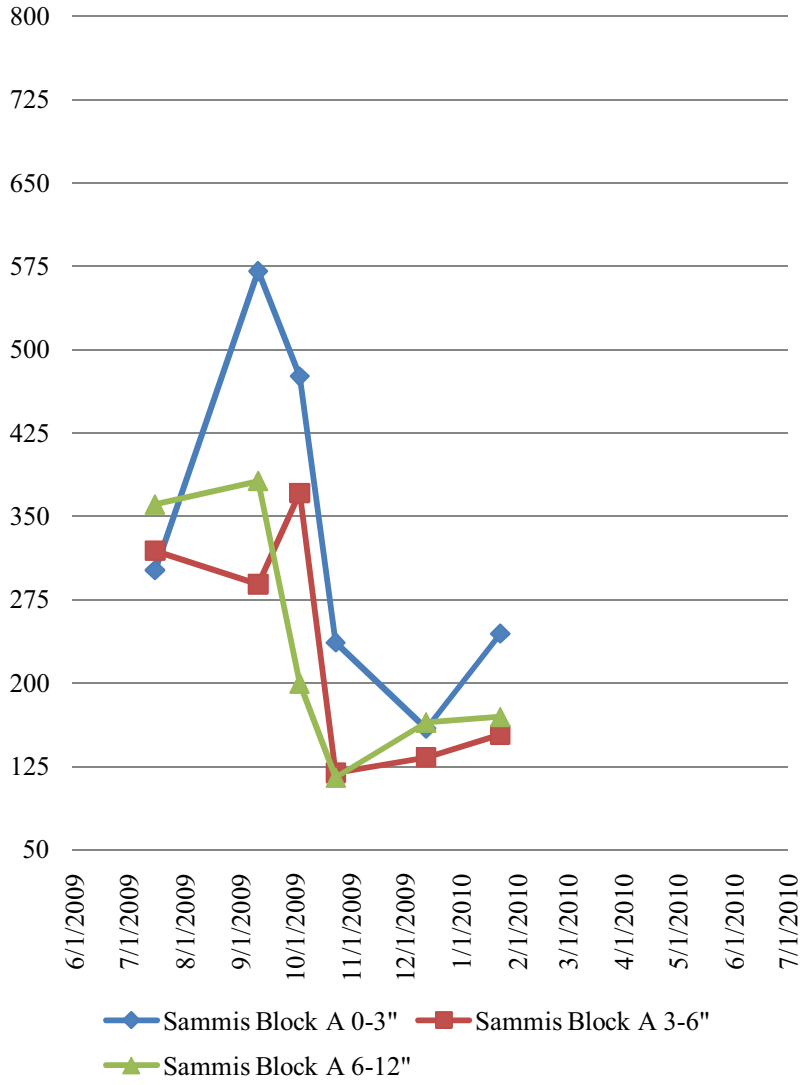
Irrigation Methods: SSS = Solid Set Sprinklers, Dp = Drip, DLS = Partial Sprinkler

Sammis Block A

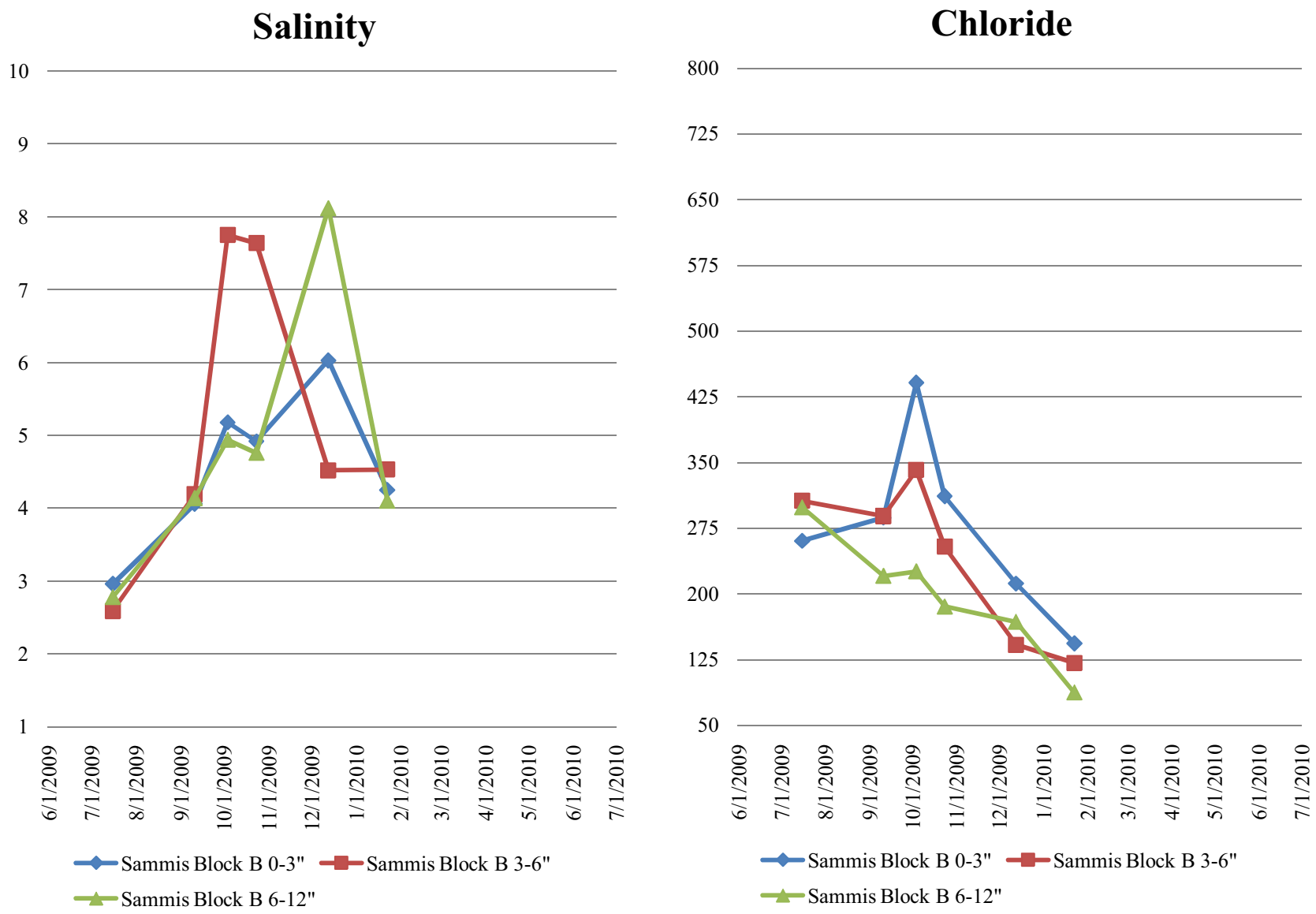
Salinity



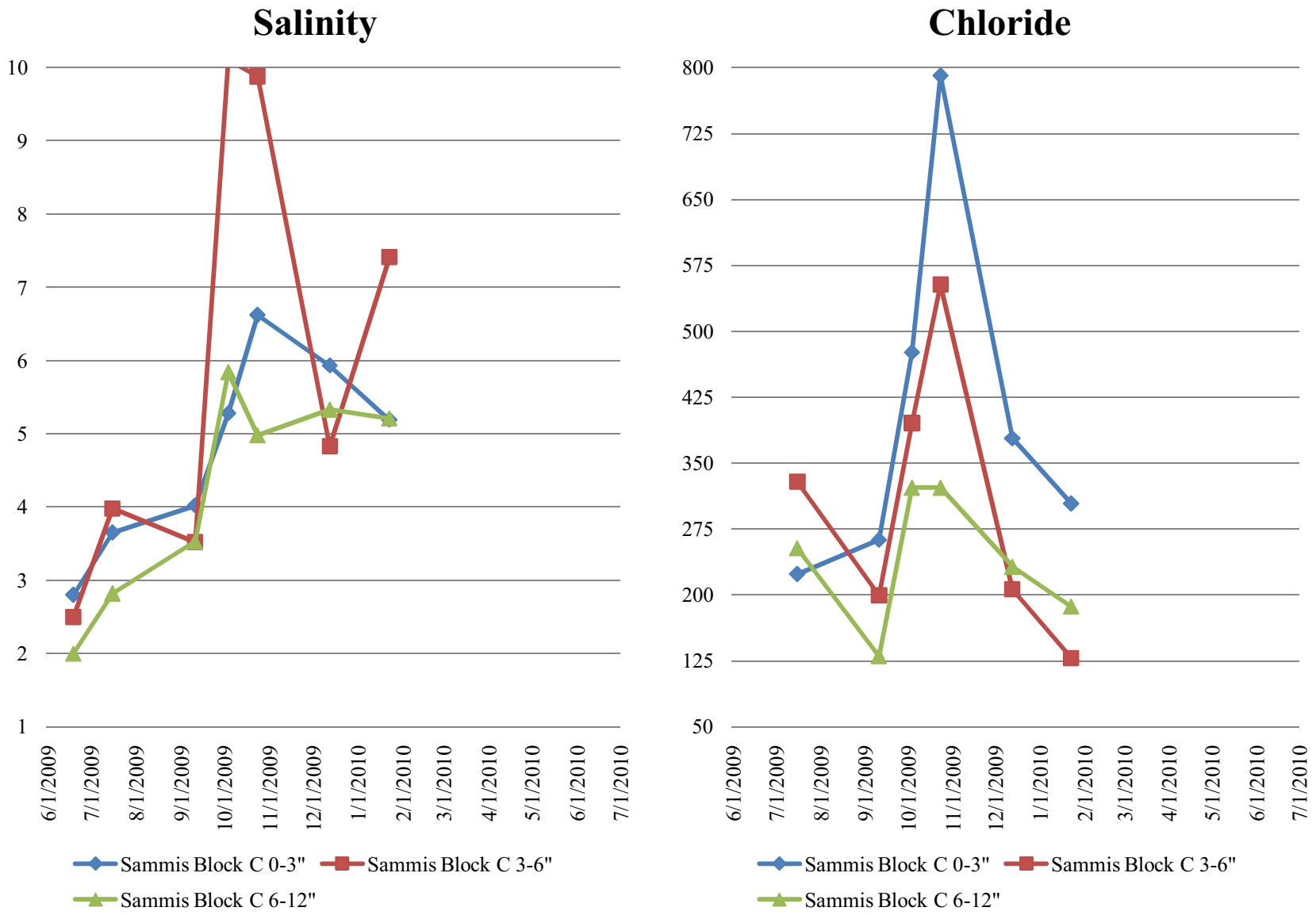
Chloride



Sammis Block B



Sammis Block C

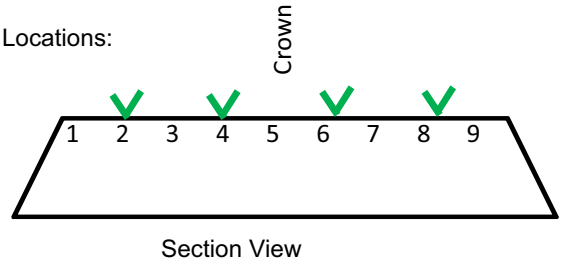


Salinity Across Strawberry Bed

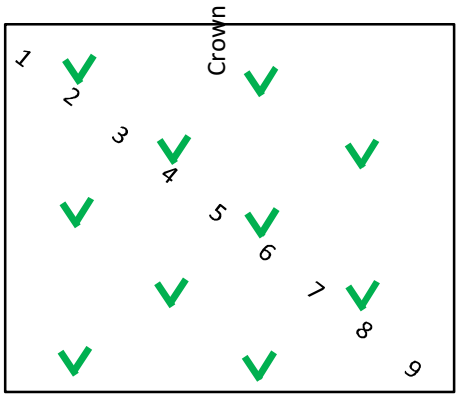
Results from 10-31-09

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Note: These are a sample from 1 location.

Sammis

Block A Drip Only

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	5.48	5.06	4.3	3.4	7	6.5	4.1	4.3	7.9
%VWC	25	28	29	37	33	34	32	21	20

Block B Partial Sprinkler

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	3.8	2.3	3	5.8	5.3	2.9	3.1	5.2	2.6
%VWC	19	25	22	35	29	30	28	31	21

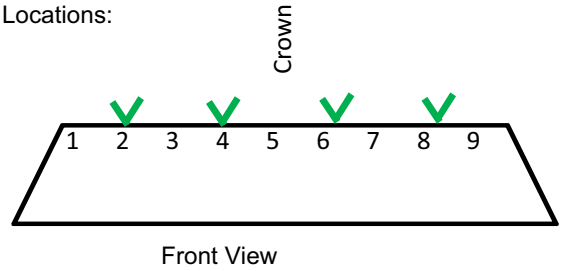
Block C Conventional

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	2.3	3.4	2.5	1.2	5.7	5	6	3.9	6.1
%VWC	26	28	35	22	32	29	40	28	31

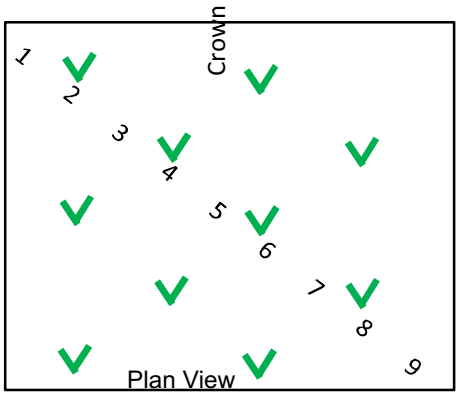
Salinity Snapshots

Results from 11-14-09

Testing Depth: 3in
Testing Locations:



Front View



Plan View

Sammis

Block A North Side od block

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	3.7	3.3	7.7	7.8	6.9	6.4	6.9	8.5	5.7
%VWC	32	24	26	30	29	23	29	24	24

Block A South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	7.5	8.5	11	9	5.4	6.2	5.2	5.3	3
%VWC	29	28	26	28	31	29	33	33	33

Block B North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	7.6	8.4	4.6	6.5	6.6	3.1	8.8	7.5	7.5
%VWC	33	27	29	41	32	26	27	32	24

Block B South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	1.7	6.5	6.8	4.7	9	4.4	4.8	12	11
%VWC	19	30	26	33	30	24	22	23	22

Block C North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	12.2	7.9	8	9.7	9	8.2	5	9.5	8.9
%VWC	29	31	29	29	25	28	31	26	22

Block C South Side

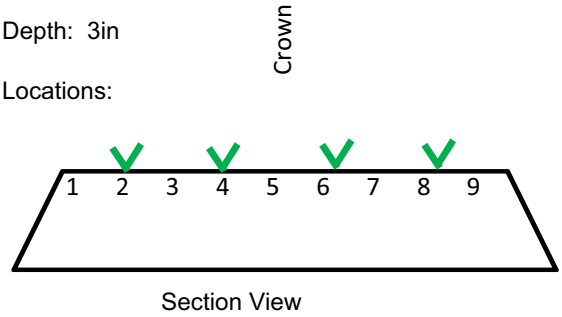
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	3.9	5.2	10.7	4.7	6.6	8	3.7	8.1	5
%VWC	24	26	24	29	31	27	18	22	25

Salinity Across Strawberry Bed

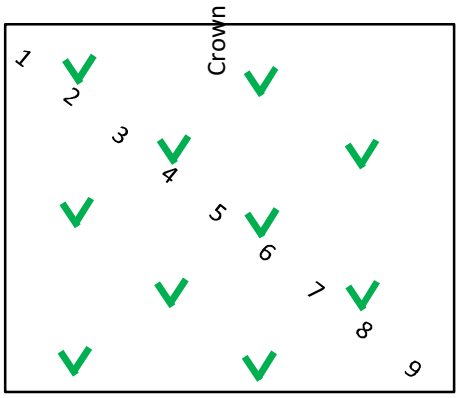
Results from 12-17-09

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Sammis

Block A Drip Only — North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	6.6	0.7	10	6.9	9.7	2	0.5	5.3	3.6
%VWC	26	25	24	23	25	29	21	22	19

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	12.5	3.8	3.8	11.7	13.7	11.1	4	5.4	15.3
%VWC	13	17	28	26	28	24	29	24	15

Block B Partial Sprinkler — North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	7	5.6	12	1.1	9.6	6.6	7.5	2	7.7
%VWC	26	23	24	24	25	22	29	23	20

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	3	4.2	4.4	6.4	6.5	3	11.6	7.3	9.1
%VWC	23	23	25	24	23	24	25	22	24

Block C Conventional — North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	3.4	1.4	6	4.8	9.8	8.2	9.1	8.4	14.9
%VWC	20	23	29	22	26	20	25	23	13

South Side

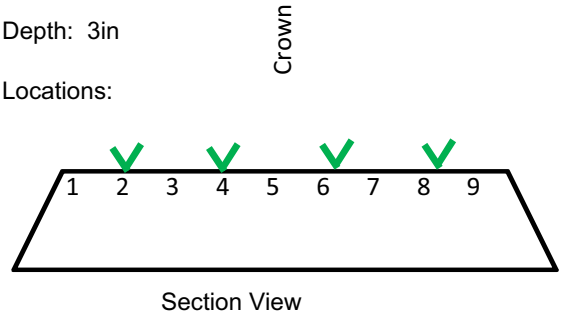
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	10.9	8.1	6.3	11	4.3	9.6	5.8	9.8	19
%VWC	17	18	29	23	25	29	30	19	16

Salinity Across Strawberry Bed

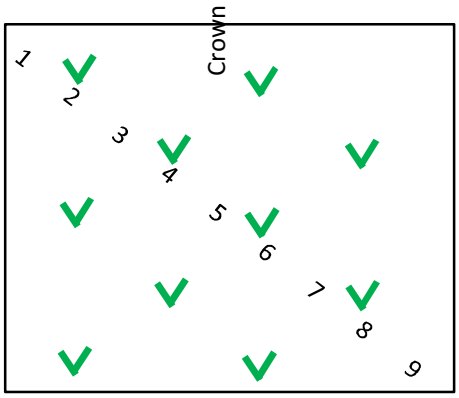
Results from 02-13-10

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Sammis

Block A Drip Only — North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	1.5	1.1	2.3	7.5	10.3	8.6	5.5	9.8	0.4
%VWC	12.9	16	21.6	28	32	21	39	35	25

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	4	8.6	6.8	7	14.3	7.8	3.6	9.1	18
%VWC	21	26	39	23	27	21	24	24	22

Block B Partial Sprinkler — North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	0.5	0.5	7.5	4.3	4.5	9.1	8.5	5.1	10.6
%VWC	14	17	23	20	20	25	24	19	17.1

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	6.6	7.8	5.5	6.7	8	10.5	7.8	8.2	7.5
%VWC	16	21	19	24	26	25	24	24	21

Block C Conventional — North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	12	9	19.6	7.1	8.3	8.5	12	7.5	9.8
%VWC	10	17	24	22	29	24	25	24	16

South Side

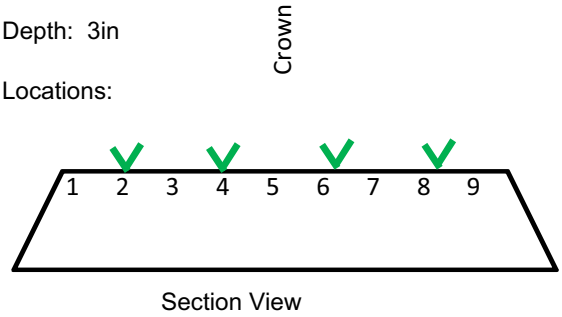
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	8.3	4.9	1.5	3.6	8	9.9	9.4	7.2	10
%VWC	25	20	21	20	23	23	24	25	10

Salinity Across Strawberry Bed

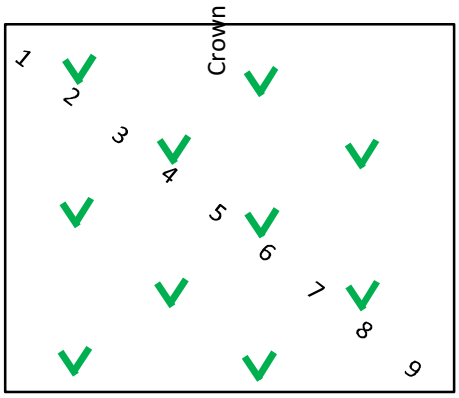
Results from 05-09-10

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Sammis

Block A Drip Only — North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	0.3	6.7	9.2	9.1	12.5	9.4	9	10.6	10
%VWC	24	27	26	34	30	29	29	28	25

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	0.4	6	5.3	13.7	11.4	10.8	9	0.6	12
%VWC	24	32	33	24	32	28	24	24	23

Block B Partial Sprinkler — North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	13.8	9.6	3.5	7.2	8.2	8.4	7.1	9.2	0.1
%VWC	28	28	17	35	33	34	34	33	28

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	9.2	4.5	2.6	9	10	10.7	8.3	10.8	18
%VWC	28.9	28	26	25	29	22	24	26	22

Block C Conventional — North Side

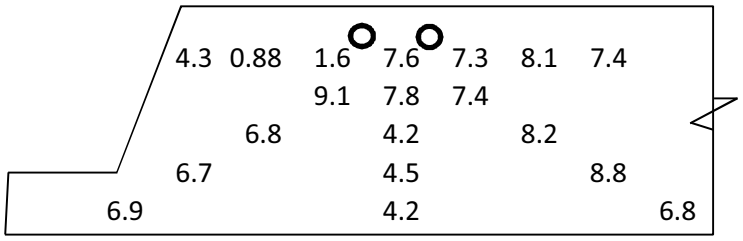
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	6	7.1	7.3	13.3	10.5	13.4	11.9	9.8	3.6
%VWC	20	25	25	23	27	28	21	23	17

South Side

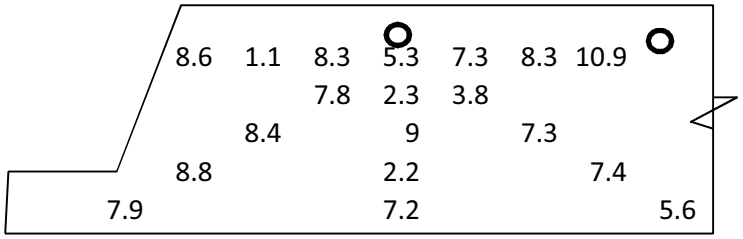
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	11	11	10.5	9.9	8.3	5.1	8.2	8.5	3.8
%VWC	22	28	25	26	28	24	36	32	21

Soil Profile Salinity - Radial Section

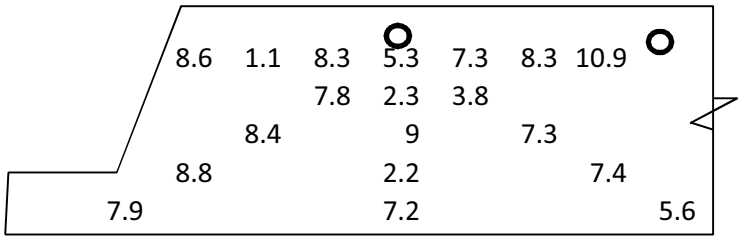
Sammis
2-Jul-10
Block A ds/m



Sammis
2-Jul-10
Block B ds/m

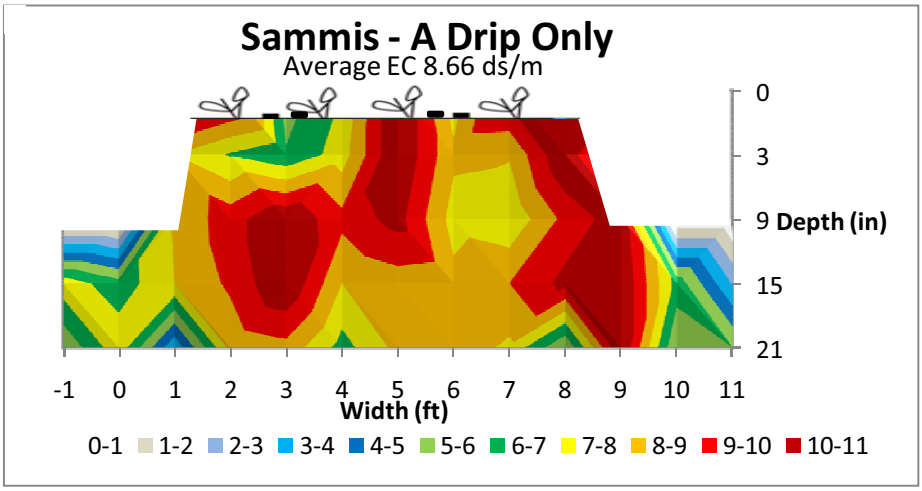


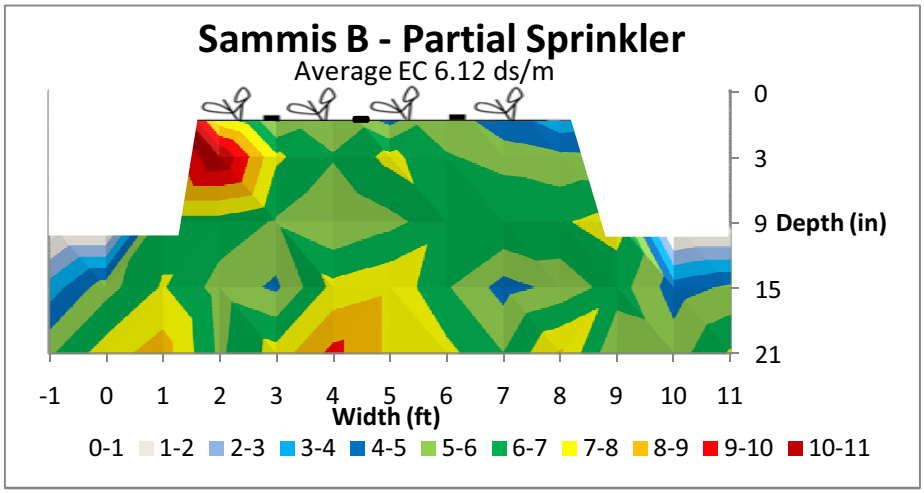
Sammis
2-Jul-10
Block C ds/m

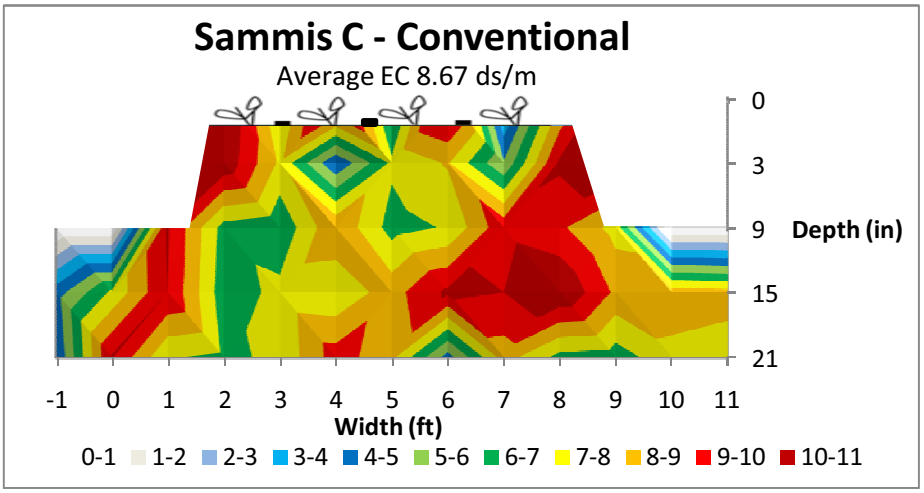


Salinity Contours

Date: 06/30/10







Eclipse:

Detailed Salinity Data

Evaluation of Modified Drip Irrigation Strategies on Strawberries - Eclipse Blocks

Date:		6/19/2009			7/16/2009			9/11/2009			10/4/2009			10/24/2009			12/13/2009			1/23/2010			6/7/2010		
		Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)
Block A	3"	DLS	1.60	-	DLS	3.65	162.40	DLS	5.61	105.00	DLS	7.04	423.50	DLS	5.84	157.50									
	6"	DLS	1.80	-	DLS	-	-	DLS	11.50	76.30	DLS	8.60	189.00	DLS	5.28	94.50									
	12"	DLS	1.70	-	DLS	3.77	178.50	DLS	4.68	94.50	DLS	5.78	113.75	DLS	5.52	103.25									
Block B	3"	DLS	-	-	DLS	3.56	124.60	DLS	4.61	136.50	DLS	6.77	222.25	DLS	5.57	243.25									
	6"	DLS	-	-	DLS	3.72	155.40	DLS	8.09	126.00	DLS	6.99	150.50	DLS	6.69	140.00									
	12"	DLS	-	-	DLS	4.51	153.30	DLS	4.89	59.50	DLS	5.85	127.75	DLS	5.21	119.00									
Block C	3"	DLS	-	-	DLS	3.73	161.70	DLS	6.26	262.50	DLS	6.83	308.00	DLS	5.18	103.25	DLS	0.05	142.45	DLS	3.93	32.90	DLS		
	6"	DLS	-	-	DLS	3.66	148.40	DLS	4.50	213.50	DLS	7.89	159.25	DLS	6.80	87.50	DLS	4.55	85.75	DLS	5.26	49.00	DLS		
	12"	DLS	-	-	DLS	3.17	76.30	DLS	4.33	192.50	DLS	6.59	129.50	DLS	6.55	135.10	DLS	4.71	71.75	DLS	4.62	30.80	DLS		
Block I	3"	SSS	2.30	-	SSS	3.85	155.05	SSS	7.42	567.00	SSS	4.80	155.75	SSS	4.33	112.00	SSS	6.39	153.30	SSS	3.89	25.20	SSS		
	6"	SSS	2.20	-	SSS	3.69	139.65	SSS	6.52	539.00	SSS	3.97	77.00	SSS	4.13	77.00	SSS	8.62	102.90	SSS	5.49	28.70	SSS		
	12"	SSS	2.00	-	SSS	3.53	93.10	SSS	4.68	215.25	SSS	3.78	85.40	SSS	4.19	85.75	SSS	3.88	55.30	SSS	4.69	26.60	SSS		

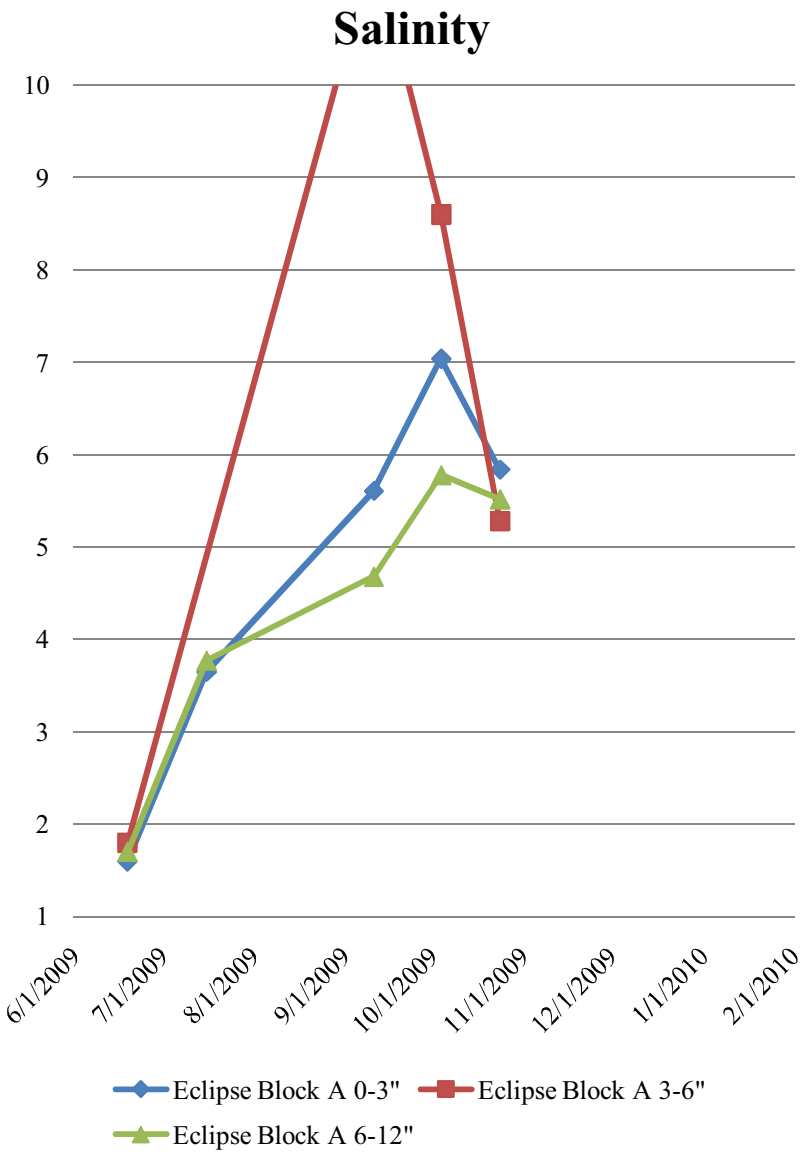
Results Pending

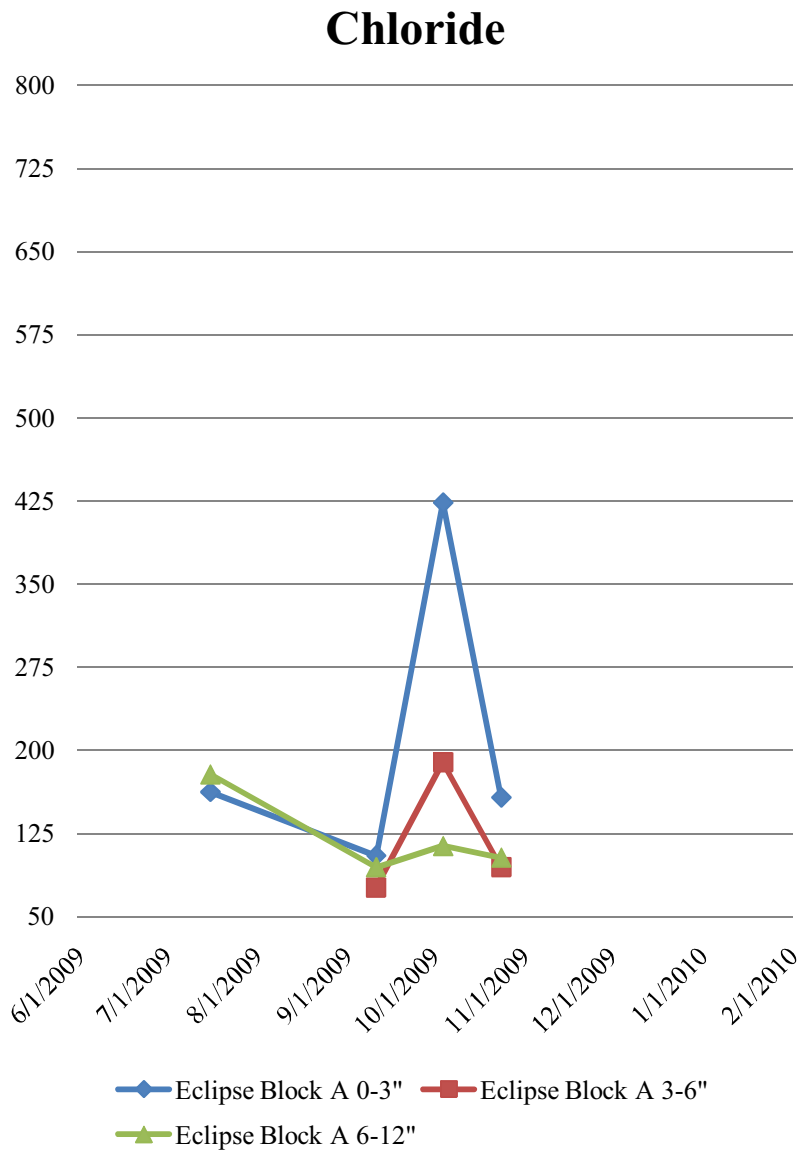
Evaluation of Modified Drip Irrigation Strategies on Strawberries - Eclipse Blocks

Date:		6/19/2009			7/16/2009			9/11/2009			10/4/2009			10/24/2009			12/13/2009			1/23/2010			6/7/2010		
		Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)
Block II	3"	SSS	-	-	SSS	4.25	273.00	SSS	5.93	120.75	SSS	5.21	166.25	SSS	4.22	84.00									
	6"	SSS	-	-	SSS	4.12	278.25	SSS	6.62	259.00	SSS	5.62	82.25	SSS	5.42	61.25									
	12"	SSS	-	-	SSS	3.69	170.80	SSS	4.15	50.75	SSS	4.22	70.00	SSS	4.20	52.50									
Block III	3"	SSS	-	-	SSS	3.98	132.30	SSS	3.98	161.70	SSS	5.54	165.20	SSS	3.48	57.40									
	6"	SSS	-	-	SSS	3.85	227.50	SSS	4.08	161.00	SSS	3.57	67.90	SSS	3.60	58.80									
	12"	SSS	-	-	SSS	3.67	148.75	SSS	3.98	72.80	SSS	4.13	73.50	SSS	3.64	50.40									

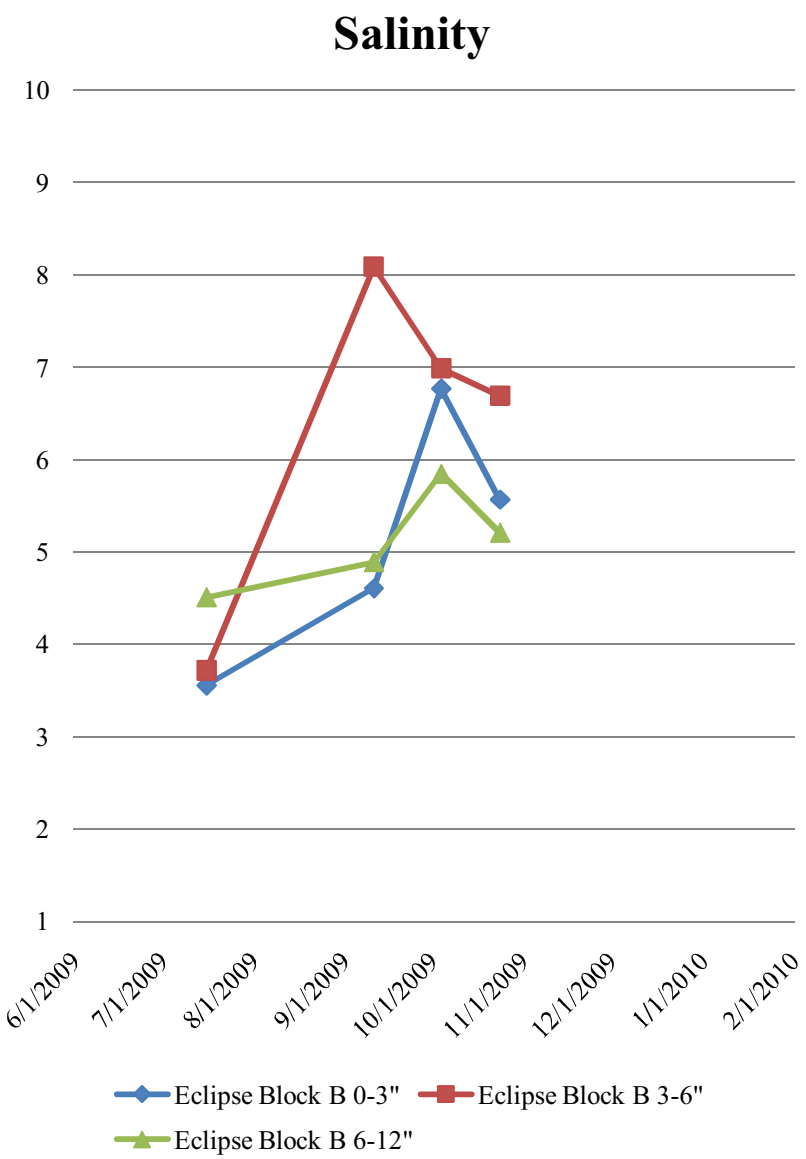
Irrigation Methods: SSS = Solid Set Sprinklers, Dp = Drip, DLS = Partial Sprinkler

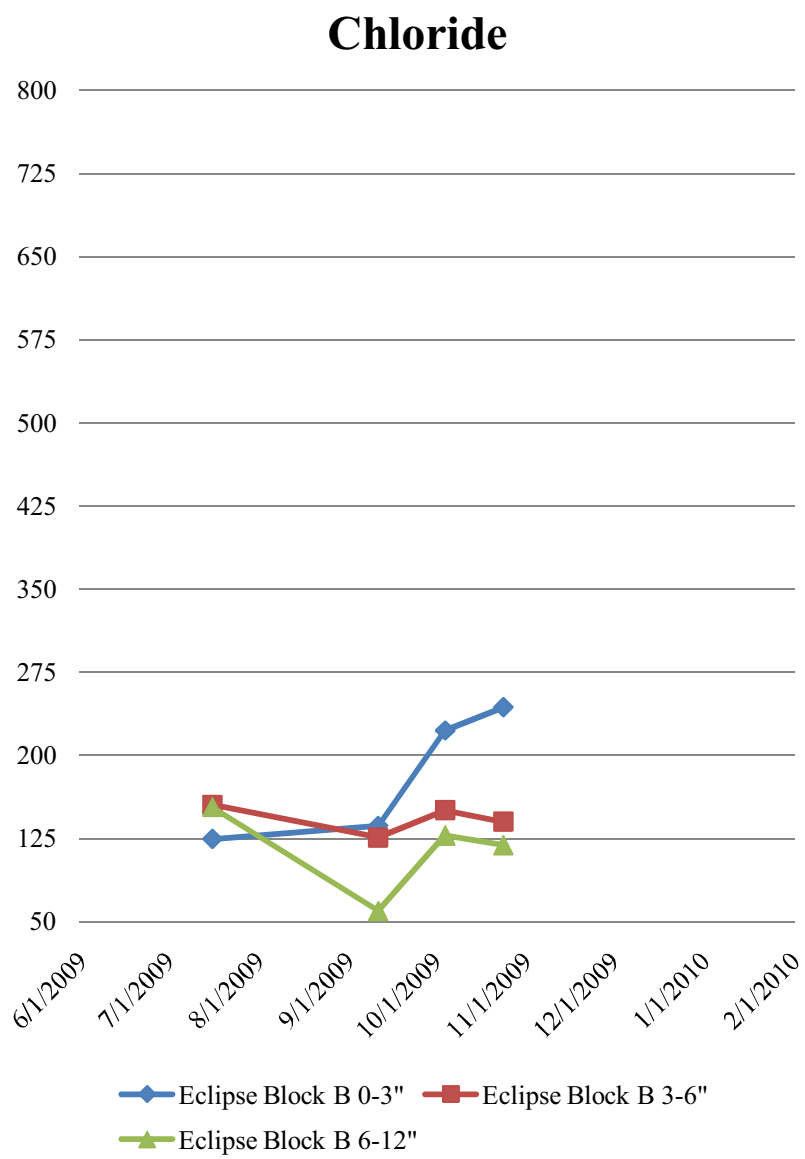
Eclipse Block A





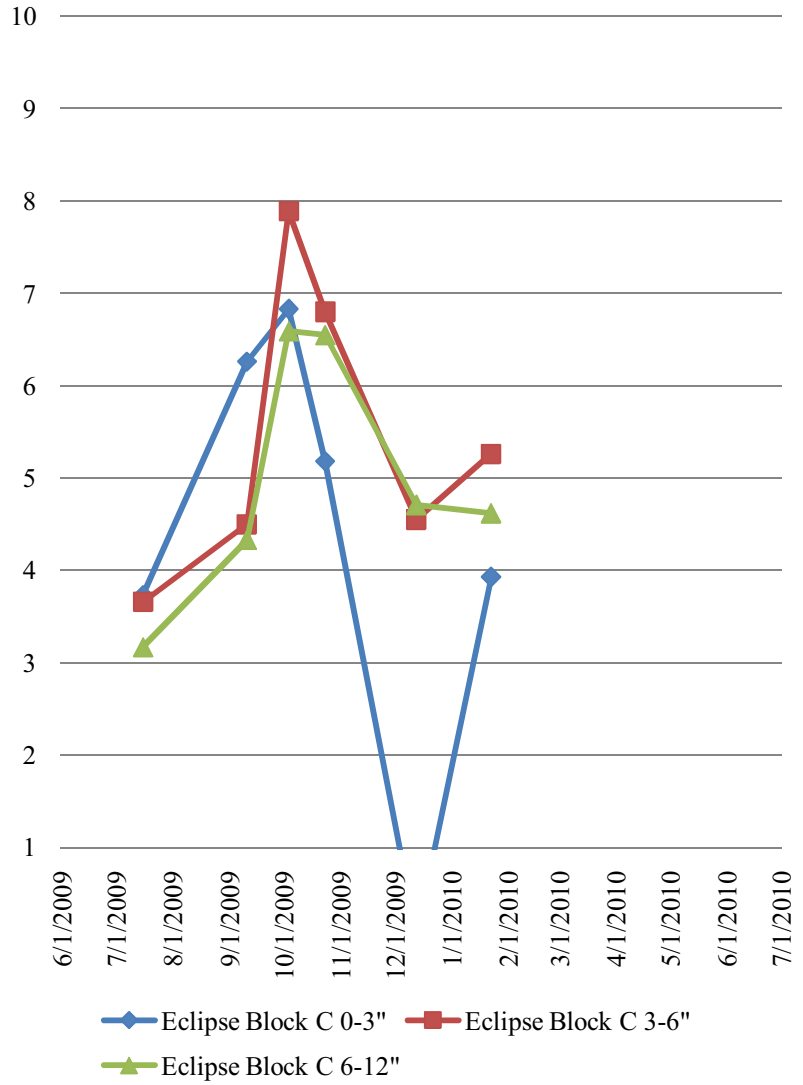
Eclipse Block B



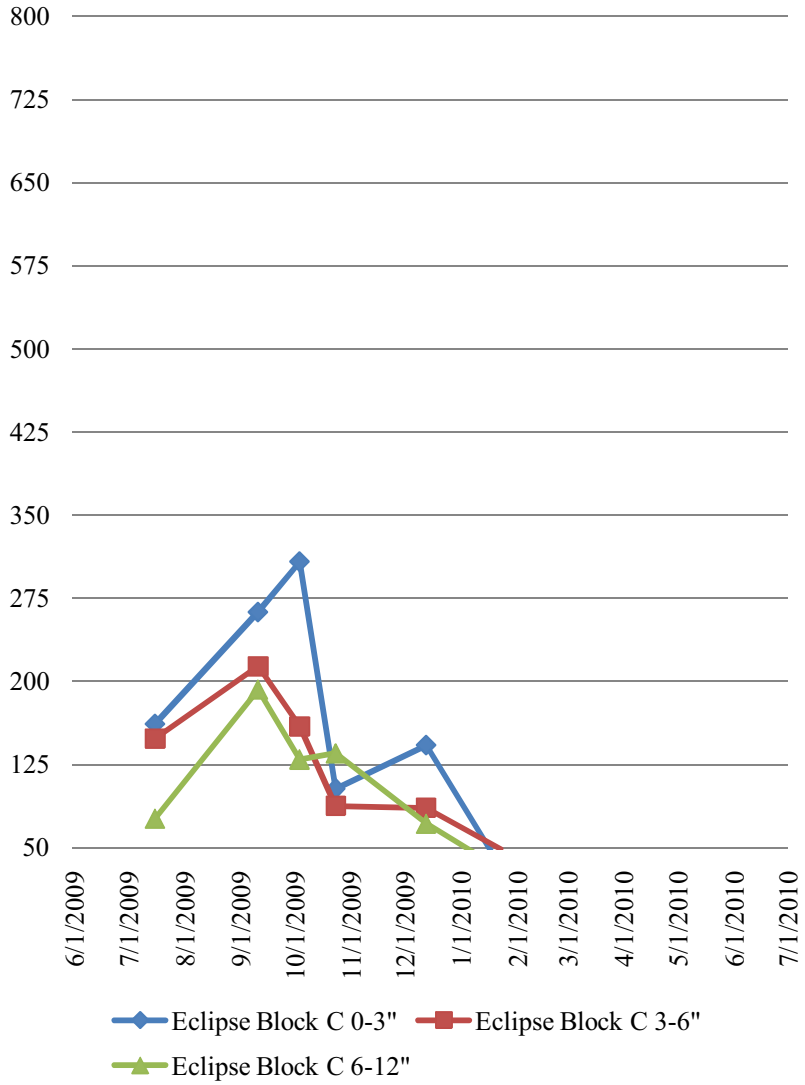


Eclipse Block C

Salinity

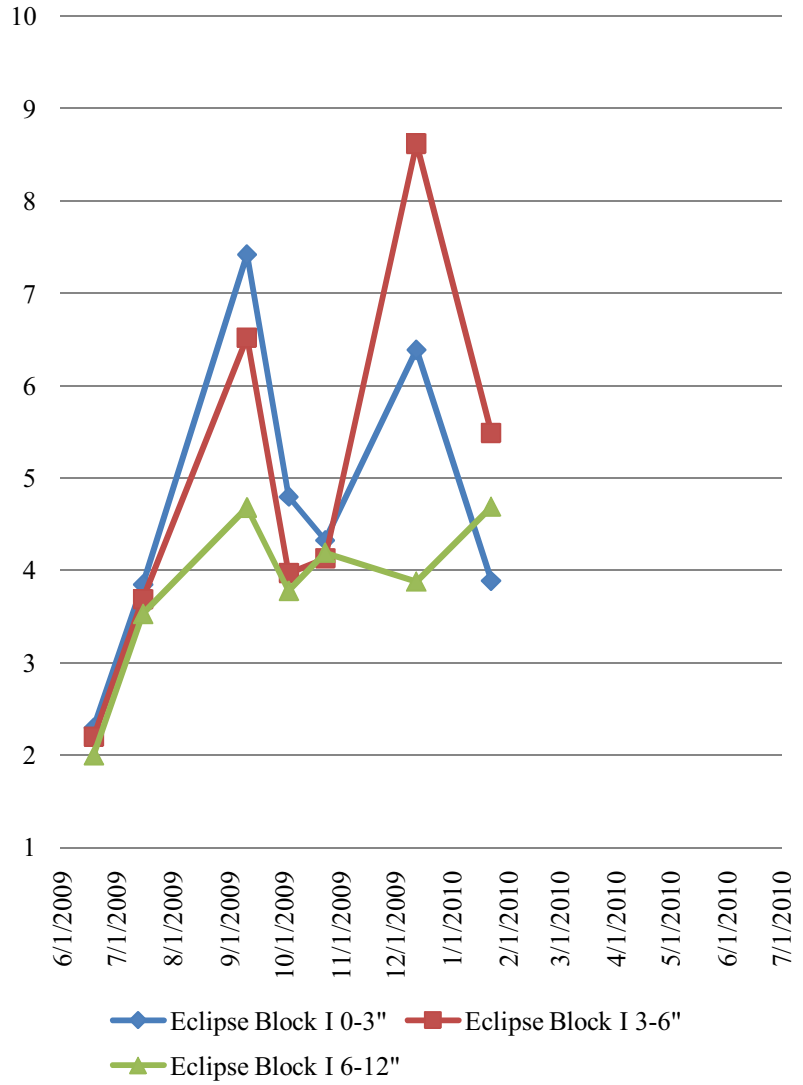


Chloride

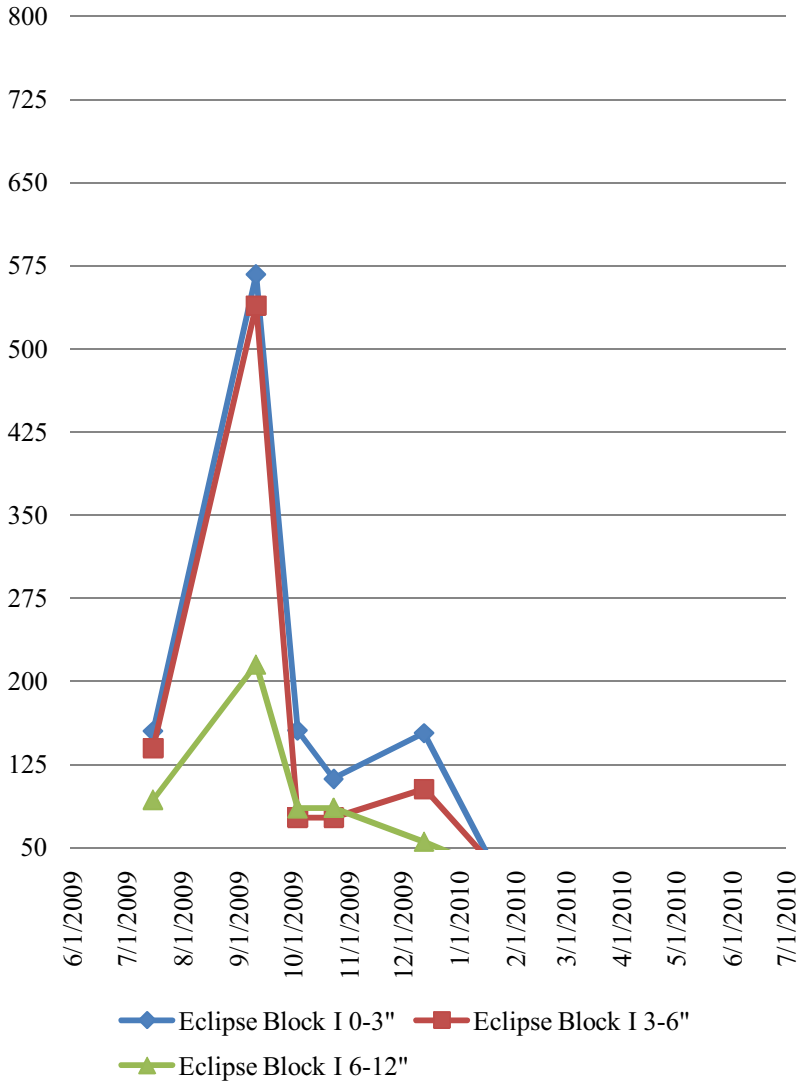


Eclipse Block I

Salinity

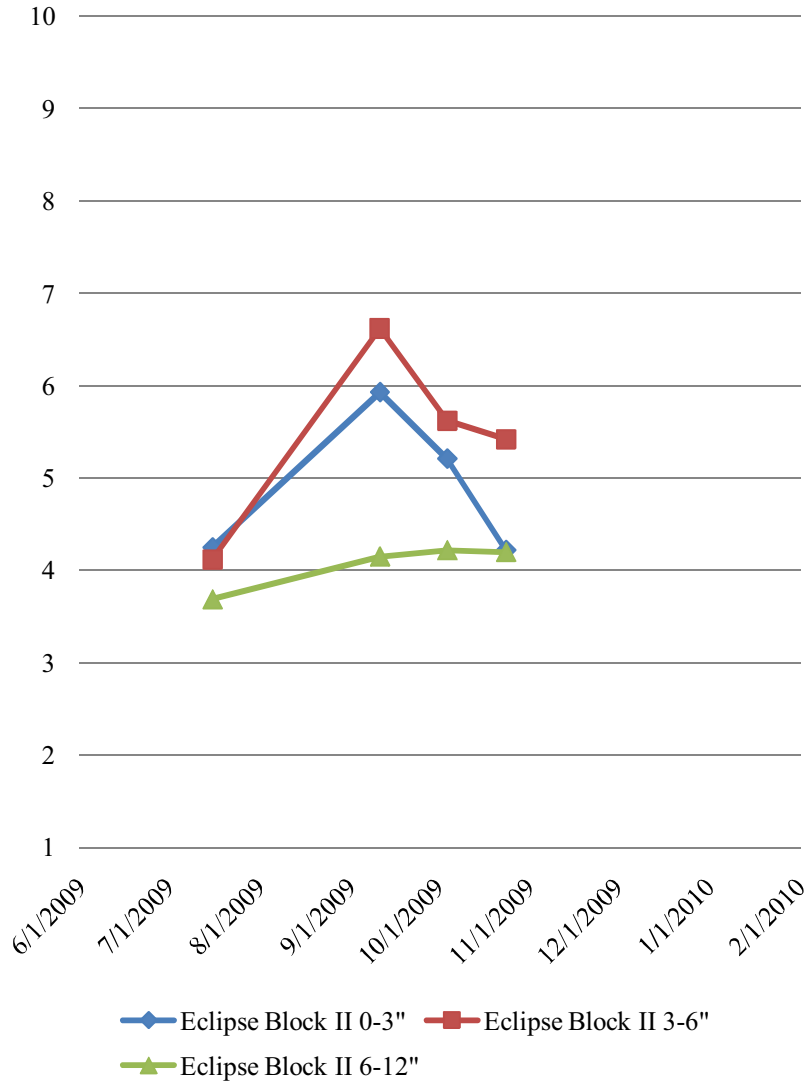


Chloride

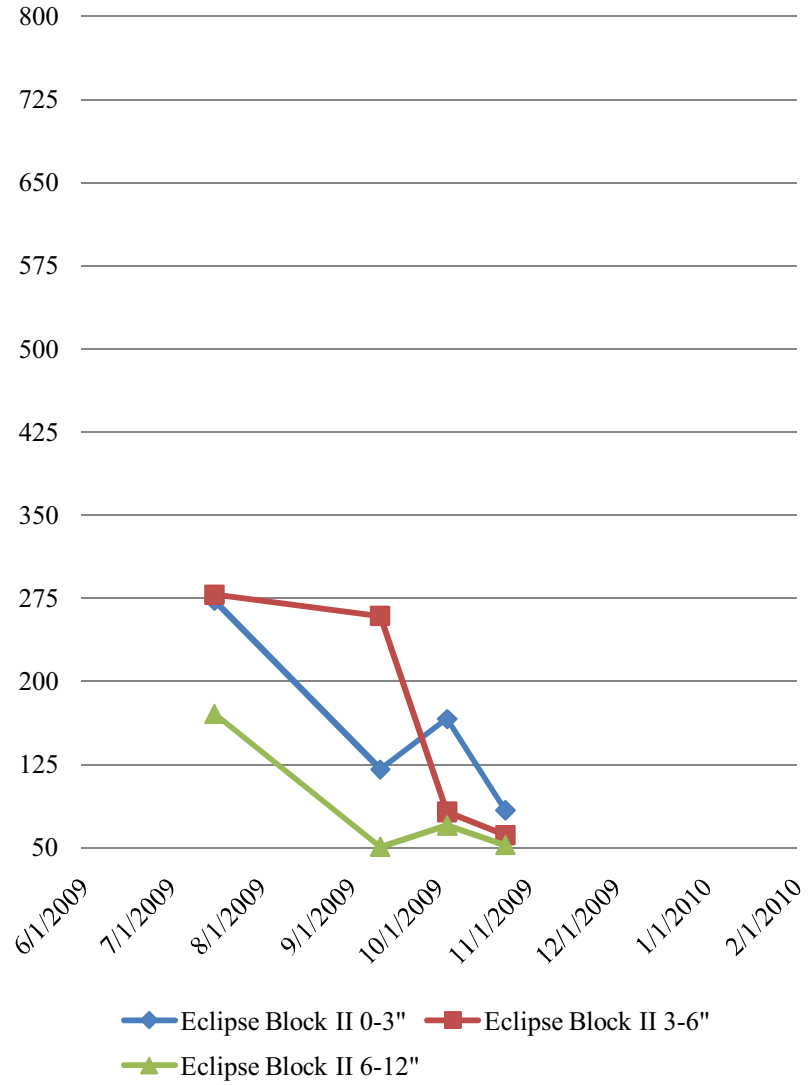


Eclipse Block II

Salinity

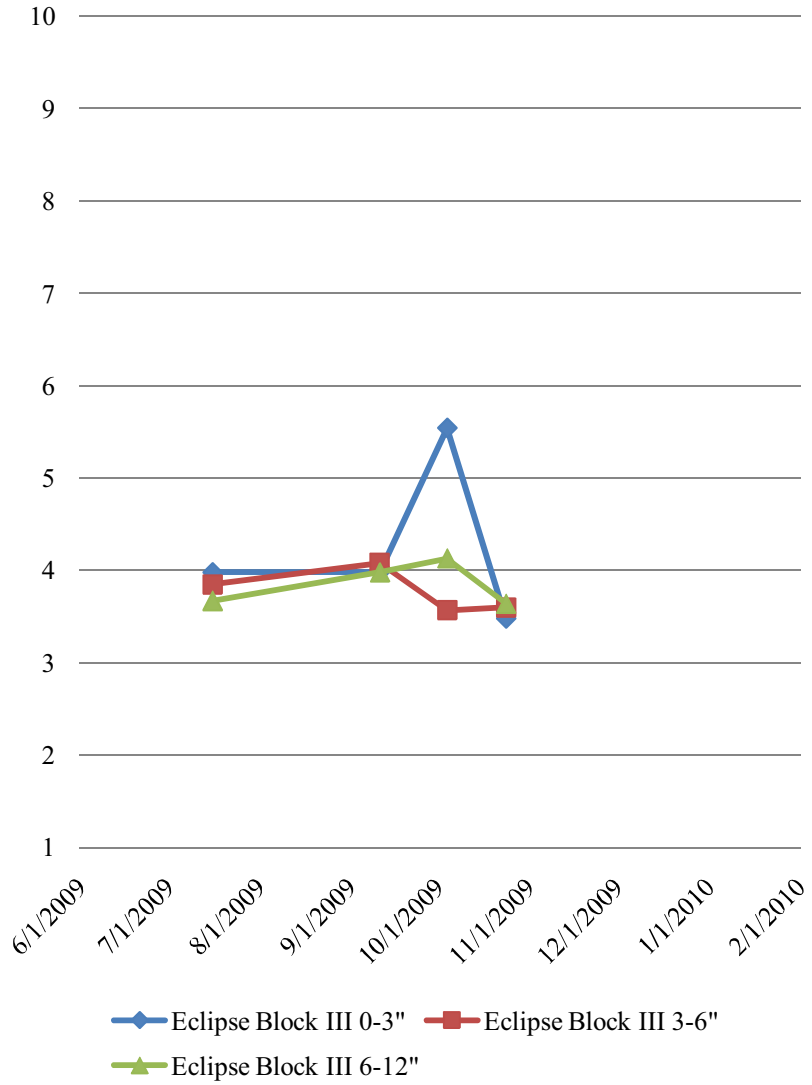


Chloride

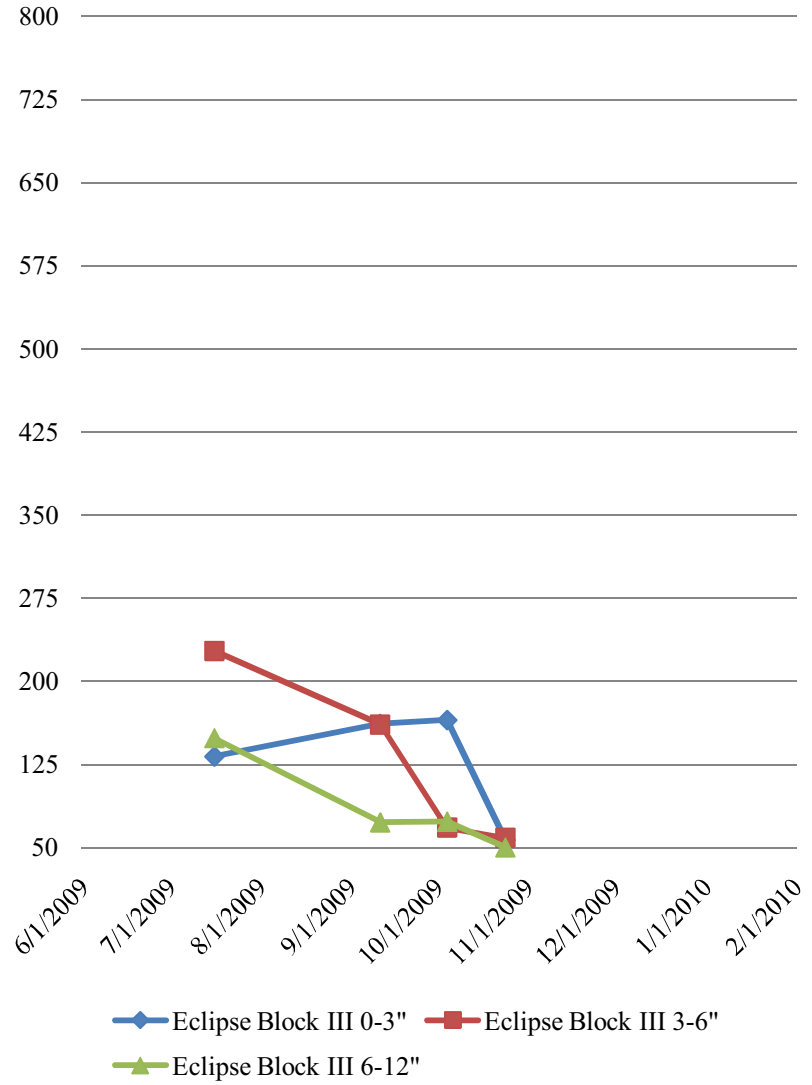


Eclipse Block III

Salinity



Chloride

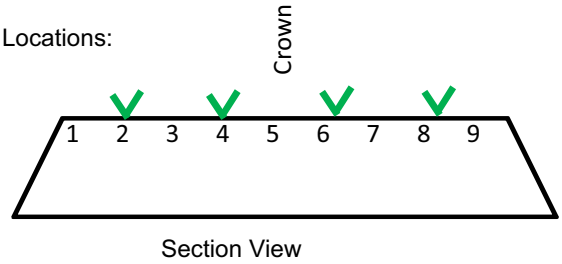


Salinity Across Strawberry Bed

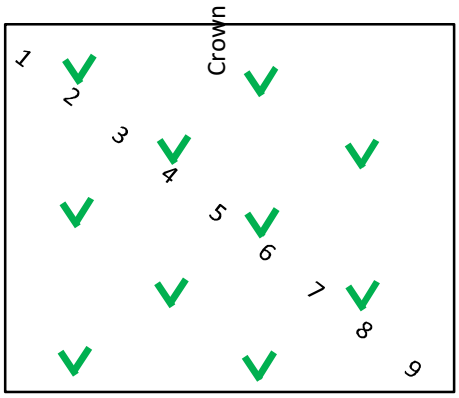
Results from 10-31-09

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Note: These are a sample from 1 location.

Eclipse

Block C Partial Sprinkler

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	4	5.5	9.2	5	8.6	3.7	6.2	6.2	3.5
%VWC	24	28	29	29	25	24	24	22	22

Block I Conventional

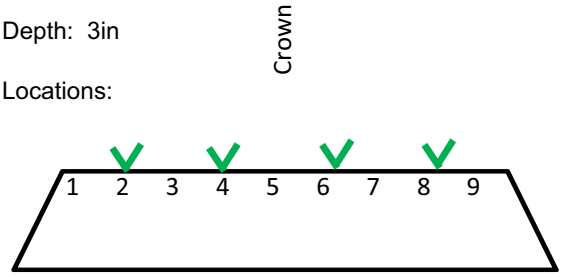
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	1.8	1.9	5.6	3.7	5.4	5.3	8.4	1.6	2.4
%VWC	24	25	24	34	24	26	25	21	19

Salinity Across Strawberry Bed

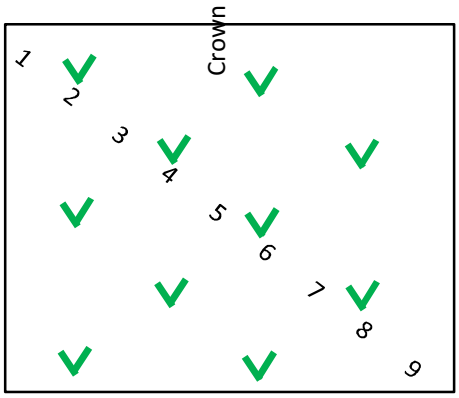
Results from 12-17-09

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Eclipse

	Block C	Partial Sprinkler							North Side
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	3.2	3.3	7	5.7	4.9	4.4	6	6.9	3.7
%VWC	21	19	18	22	24	20	25	23	19
	7								South Side
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	5.8	5.2	6.3	5	6.8	7.8	7.7	7.6	3.4
%VWC	24	21	21	23	22	21	23	23	17

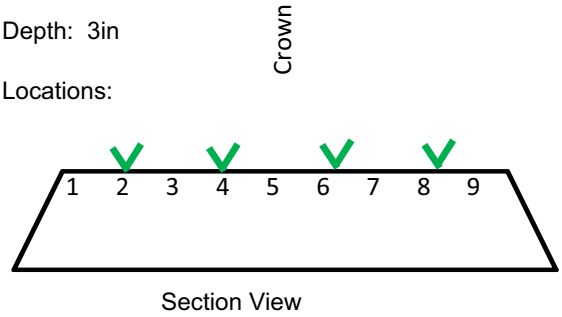
	Block I	Conventional							North Side
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	4.7	4	8.1	6	9.8	4.9	9.6	5.7	11.8
%VWC	21	24	21	21	22	22	22	22	23
									South Side
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	5.9	3.8	2.9	2.5	5.8	5.1	7.8	7	11.1
%VWC	19	22	18	23	23	23	25	24	19

Salinity Across Strawberry Bed

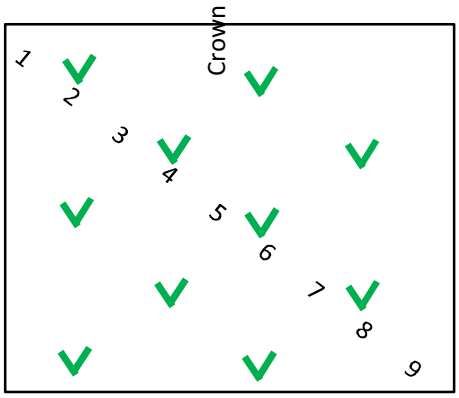
Results from 02-13-10

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Eclipse

Block C Partial Sprinkler

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	10.9	1.2	5.6	7.2	6	7.1	5.8	2	2.6
%VWC	12.5	20	23	22	22	25	21	20	23

Block I Conventional

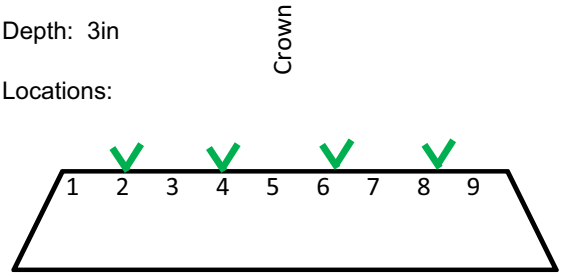
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	1.8	5.1	3.4	6	5.3	7	7.7	11.6	7.5
%VWC	22	20	19	19	21	23	22	13	15

Salinity Across Strawberry Bed

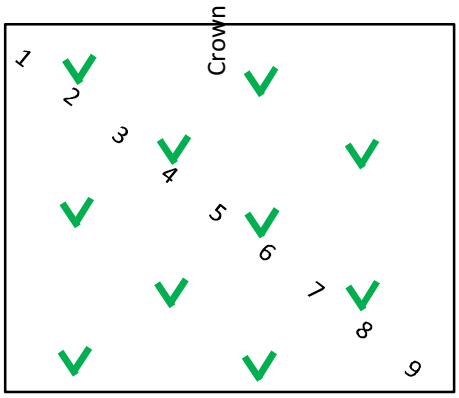
Results from 05-09-10

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Eclipse

Block C Partial Sprinkler

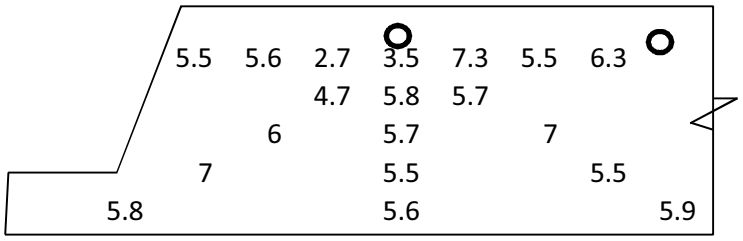
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	10.9	1.2	5.6	7.2	6	7.1	5.8	2	2.6
%VWC	12.5	20	23	22	22	25	21	20	23

Block I Conventional

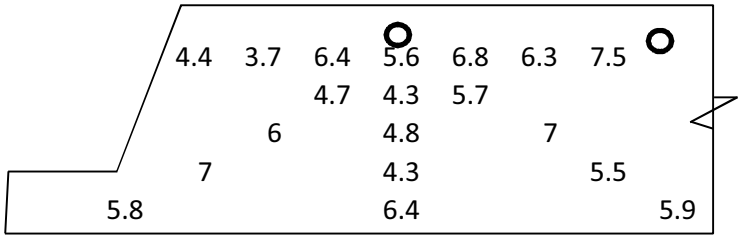
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	12.5	6	6.3	9.4	5.5	6.7	3.9	5.5	1.3
%VWC	17	22	19	23	18	23	17	16	17

Soil Profile Salinity - Radial Section

Eclipse
2-Jul-10
Block I ds/m

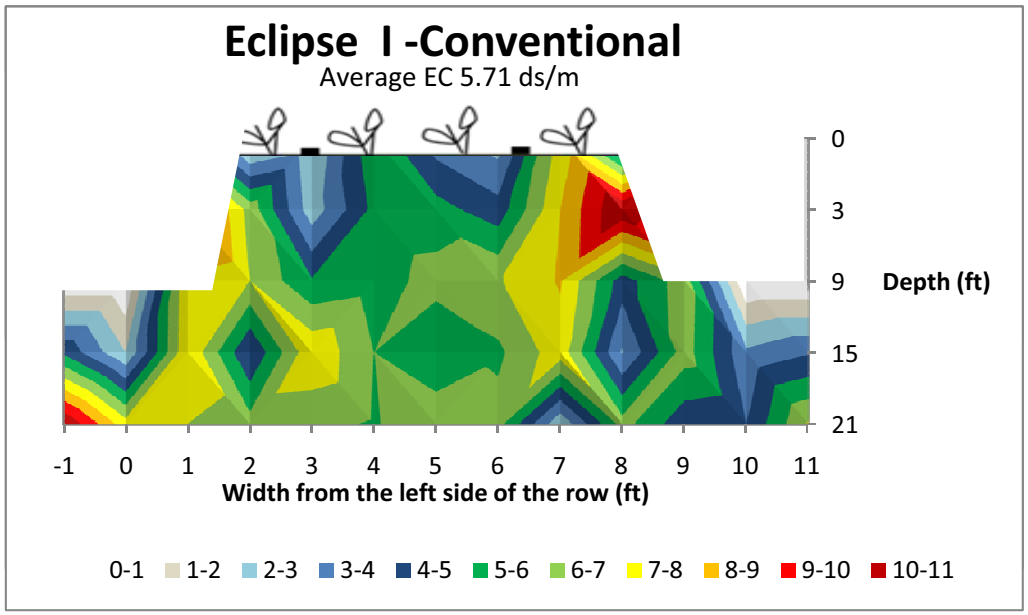


Eclipse
2-Jul-10
Block C ds/m



Salinity Contours

Date: 06/30/10



Manzanita:

Detailed Salinity Data

Evaluation of Modified Drip Irrigation Strategies on Strawberries - Manzanita Blocks

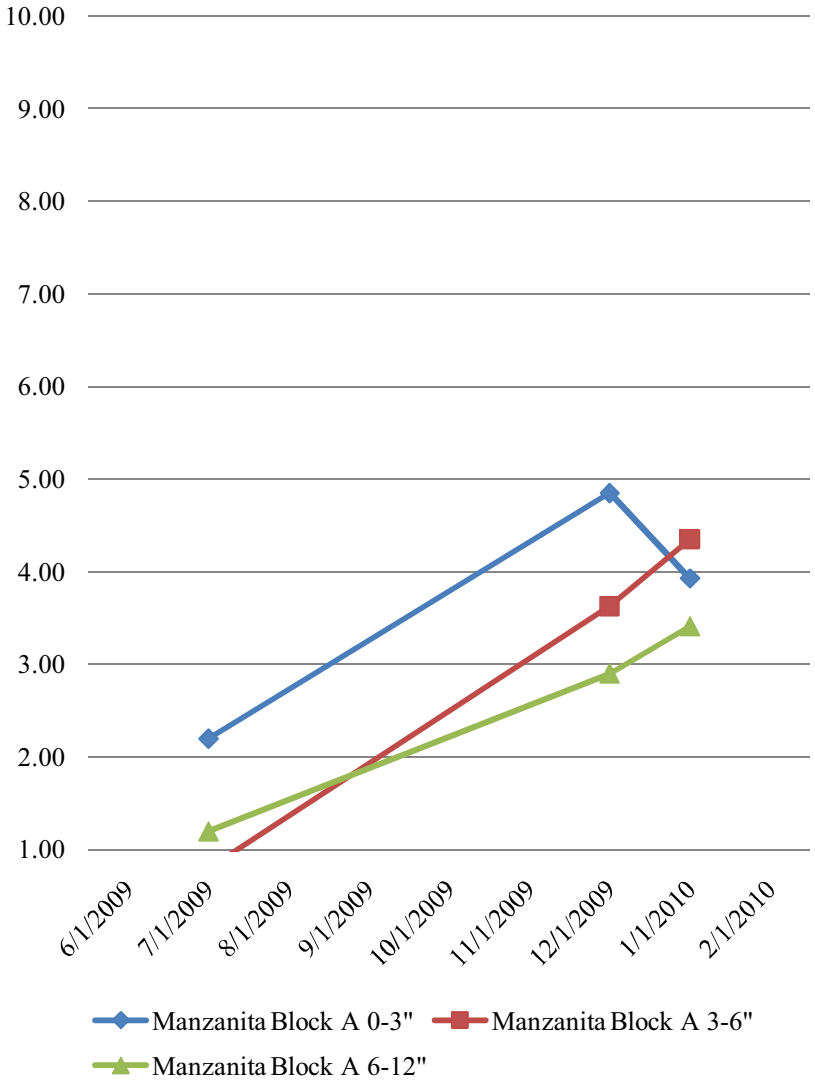
Date:		7/8/2009			12/16/2009			1/30/2010			6/7/2010		
		Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)	Irrigation Method	ECe Salinity (ds/m)	Chloride (ppm)
Block A	3"	SSS	2.20	-	SSS	4.85	301.00	SSS	3.93	70.70	SSS		
	6"	SSS	0.80	-	SSS	3.63	142.80	SSS	4.35	189.00	SSS		
	12"	SSS	1.20	-	SSS	2.90	88.55	SSS	3.41	195.30	SSS		
Block B	3"				SSS	8.67	672.00	SSS	6.78	409.50	SSS		
	6"				SSS	5.67	273.00	SSS	4.60	246.40	SSS		
	12"				SSS	5.35	297.50	SSS	4.61	235.90	SSS		
Block I	3"	DP	1.40	-	DP	4.01	182.00	DP	4.34	250.60	DP		
	6"	DP	1.20	-	DP	5.37	241.50	DP	7.21	231.00	DP		
	12"	DP	0.90	-	DP	4.00	213.50	DP	5.87	182.00	DP		
Block II	3"				DP	5.45	70.00	DP	6.34	374.50	DP		
	6"				DP	8.64	308.00	DP	9.46	455.00	DP		
	12"				DP	4.50	220.50	DP	5.51	301.00	DP		

Results Pending

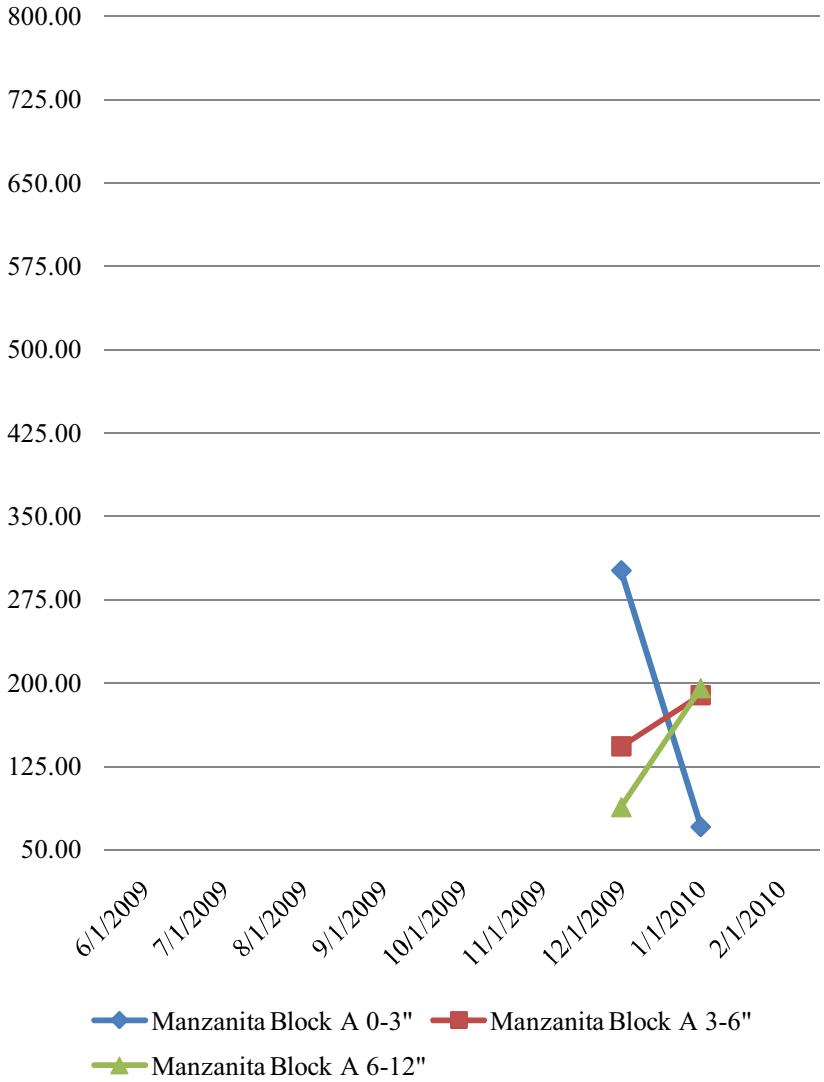
Irrigation Methods: SSS = Solid Set Sprinklers, Dp = Drip, DLS = Partial Sprinkler

Manzanita Block A

Salinity

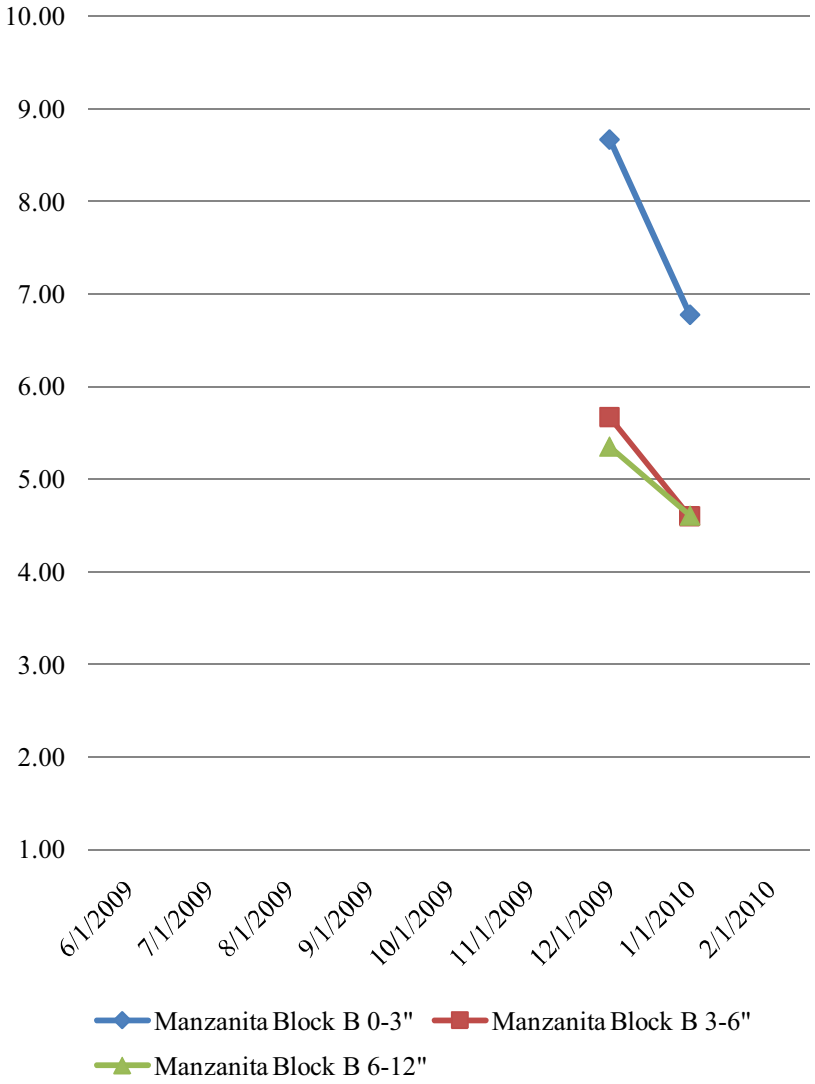


Chloride

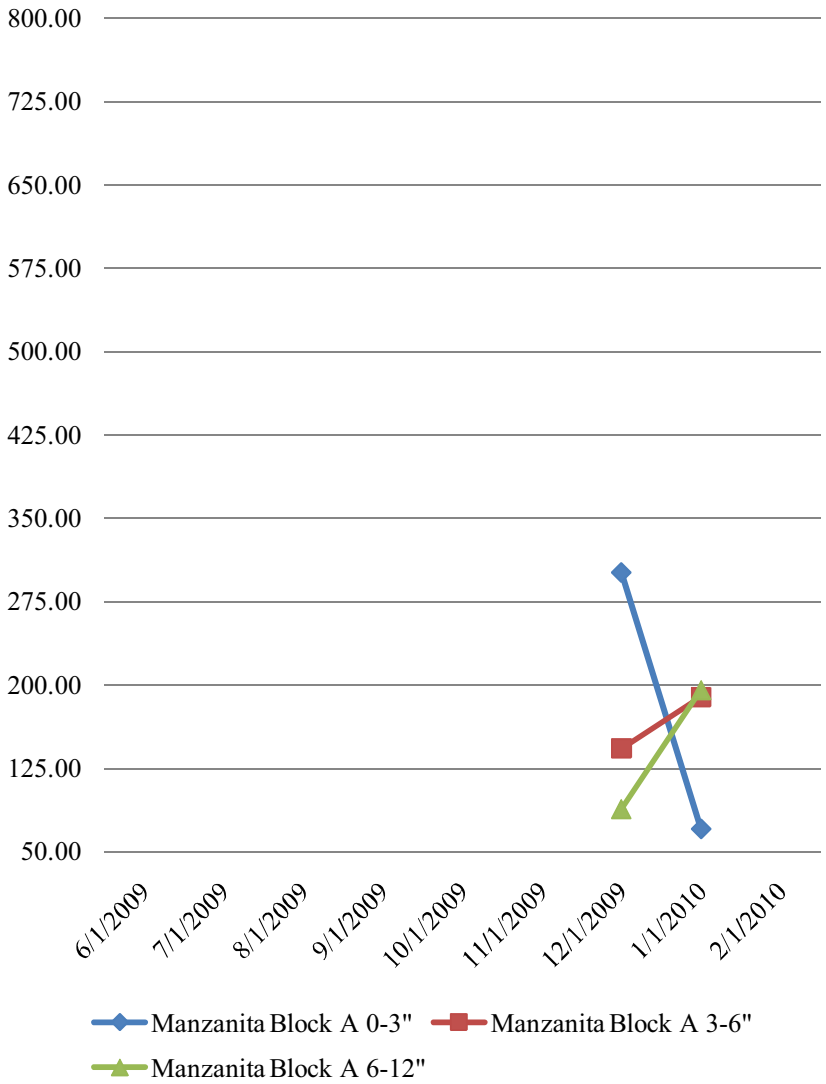


Manzanita Block B

Salinity

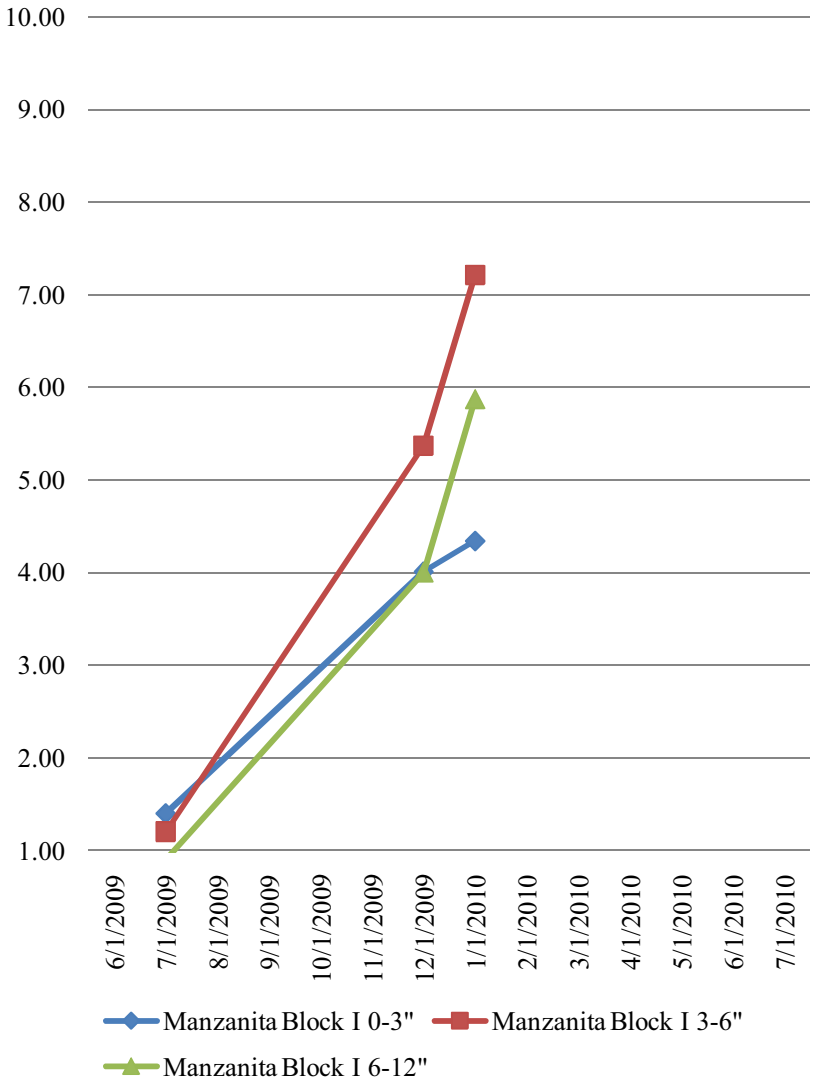


Chloride



Manzanita Block I

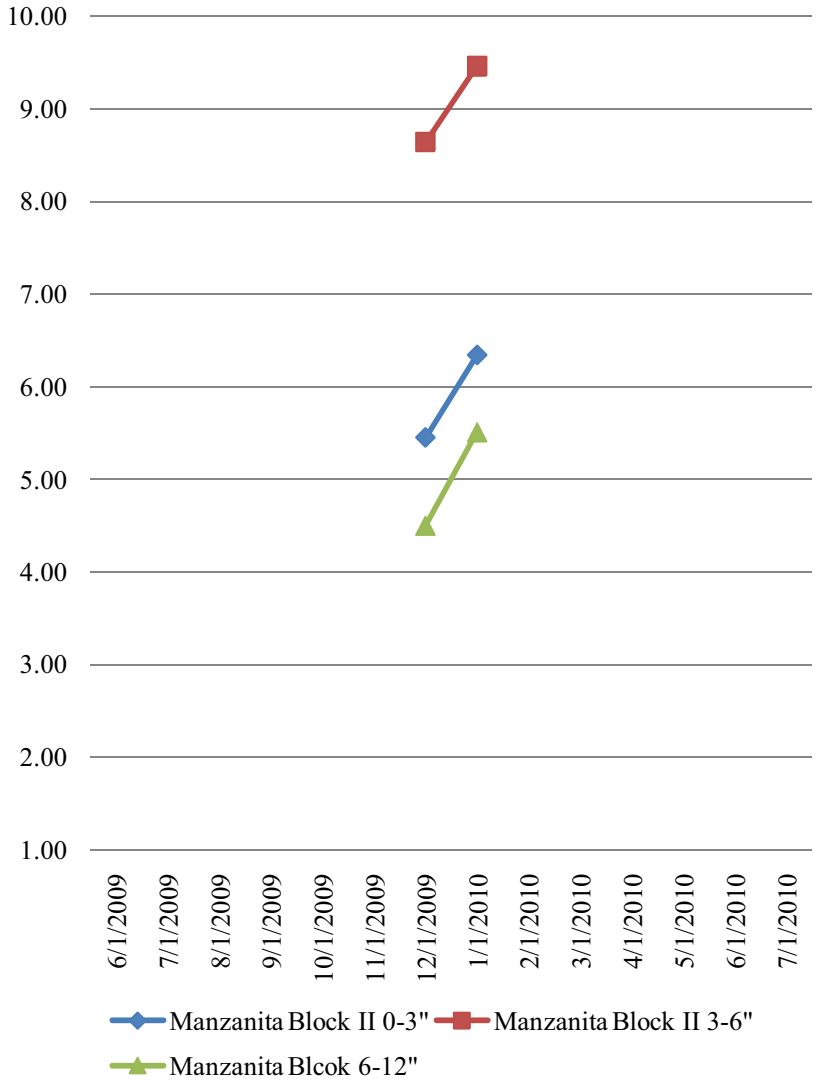
Salinity



Chloride

Manzanita Block II

Salinity



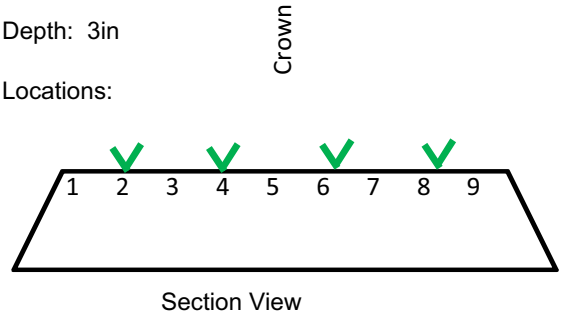
Chloride

Salinity Across Strawberry Bed

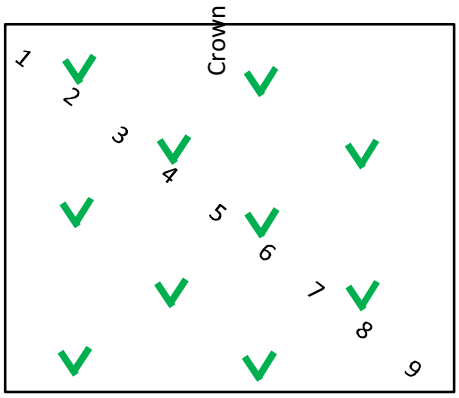
Results from 12-16-09

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Manzanita

Block A Conventional

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	1.8	2	3.6	2.7	7.4	2.3	3.6	2.4	7.3
%VWC	14	21	19	22	20	23	19	20	19

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	2.9	2.4	4.5	4.3	4.1	2	2	2.6	4.2
%VWC	17	23	23	19	21	24	27	23	17

Block B Conventional

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	2.6	3.7	5	3.4	4	4.4	6.4	2.7	7.3
%VWC	17	21	21	21	22	23	21	24	22

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	9.2	1	4.5	3.6	1	2.3	3.7	4	1.7
%VWC	16	21	28	21	22	29	24	24	20

Block I Drip Only

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	2.3	1	2.4	3	7.1	4	4.3	0.5	2.7
%VWC	14	21	22	20	22	19	18	17	21

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	0.4	1.8	4.5	3	8.2	2.8	2.8	6.5	7.7
%VWC	15	22	21	19	19	23	22	26	18

Block II Drip Only

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	6.6	4.9	4.5	3.1	6.3	3.5	3.9	2	2
%VWC	15	17	21	21	20	24	20	24	14

South Side

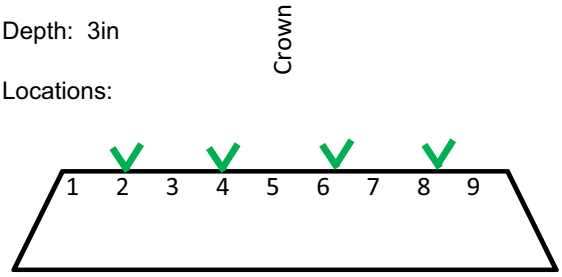
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	5.3	1.5	1.5	6.5	13.5	3.3	3.8	2	8.6
%VWC	14	21	19	15	17	23	18	24	19

Salinity Across Strawberry Bed

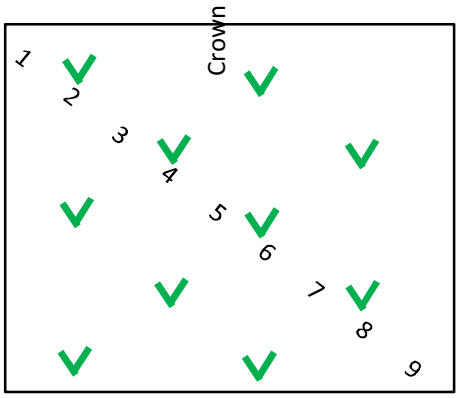
Results from 02-13-10

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Manzanita

Block A Conventional

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	4.5	9	5.5	6.6	10.2	5	2.1	2.9	3.9
%VWC	19	12	13	14	20	19	14	26	21

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	2.2	2.9	4.3	5.9	8.8	4.4	5.7	3.6	4.6
%VWC	17	19	15	17	18	17	21	21	21

Block B Conventional

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	2.7	2	4.5	3.3	4.5	3.4	5.7	7.8	1.4
%VWC	20.8	18	15	15	15	118	21	14	21

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	1.2	4.5	1.4	2.5	8.3	1	5	7.7	2.2
%VWC	16	21	28	21	22	29	24	24	20

Block I Drip Only

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	2.9	1.9	4.2	2.8	9	3.5	4.1	2.7	4
%VWC	22	14	13	21	16	19	18	16	16

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	1.3	3.7	3	3.5	6.9	3.6	3.4	2.5	4.3
%VWC	21	23	21	22	17	21	14	21	20

Block II Drip Only

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	5.3	1.2	3.4	4.7	18.5	4.9	3.9	0.7	2.9
%VWC	14	20	17	21	22	19	14	15	21

South Side

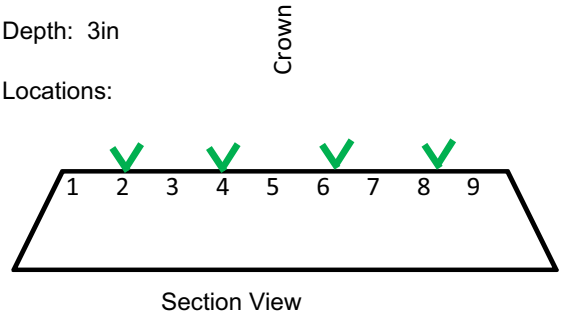
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	2.3	1.3	3	2.3	8.5	2.7	3.3	2.9	1.6
%VWC	23	16	23	19	19	21	21	16	21

Salinity Across Strawberry Bed

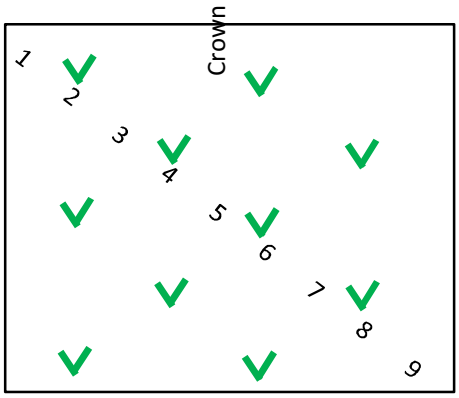
Results from 05-09-10

Testing Depth: 3in

Testing Locations:



Section View



Plan View

Manzanita

Block A Conventional

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	3.3	1.8	5	3.2	4	2.5	1.3	5.3	2
%VWC	14	14	21	17	19	18	14	21	17

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	1	7	3.2	1.8	8.2	7.2	0.5	4.7	3.9
%VWC	17	13	19	22	24	20	17	22	17

Block B Conventional

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	2.3	4.3	4.3	1.7	9.9	3.5	17	7.6	5.8
%VWC	11.1	16	12	16	19	17	12	16	12

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	4.9	0.8	6.5	4.1	8.1	4.8	0.3	2.4	16.6
%VWC	16	13	19	15	13	16	16	18	11.2

Block I Drip Only

North Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	0.5	0.5	1.1	5.2	9.2	8.9	7.3	2.8	13.6
%VWC	18	14	17	16	16	16	14	14	12

South Side

Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	0.5	4.3	9.1	6.9	4.3	10.4	5.6	8.2	2.1
%VWC	18	13	13	15	15	17	13	11	15

Block II Drip Only

North Side

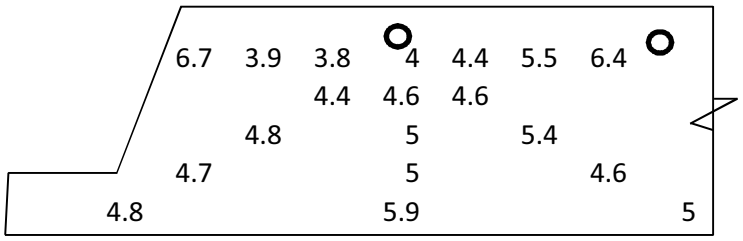
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	1.4	3.1	5.6	2	6.2	7.3	9.2	5.9	3.9
%VWC	13	15	14	14	17	16	19	16	15

South Side

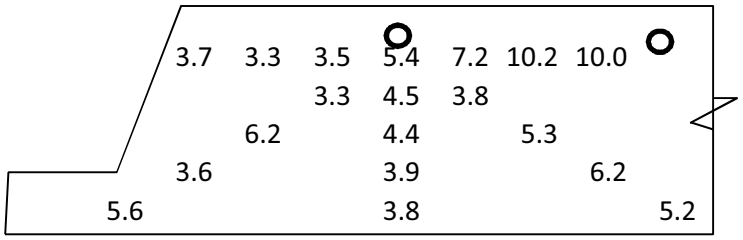
Location	1	2	3	4	5	6	7	8	9
EC (ds/m)	13.2	8.8	11.3	9.7	18.2	9.7	6.6	5.5	9.4
%VWC	12	18	17	17	16	17	13	20	14

Soil Profile Salinity - Radial Section

Manzanita
3-Jun-10
Block I ds/m

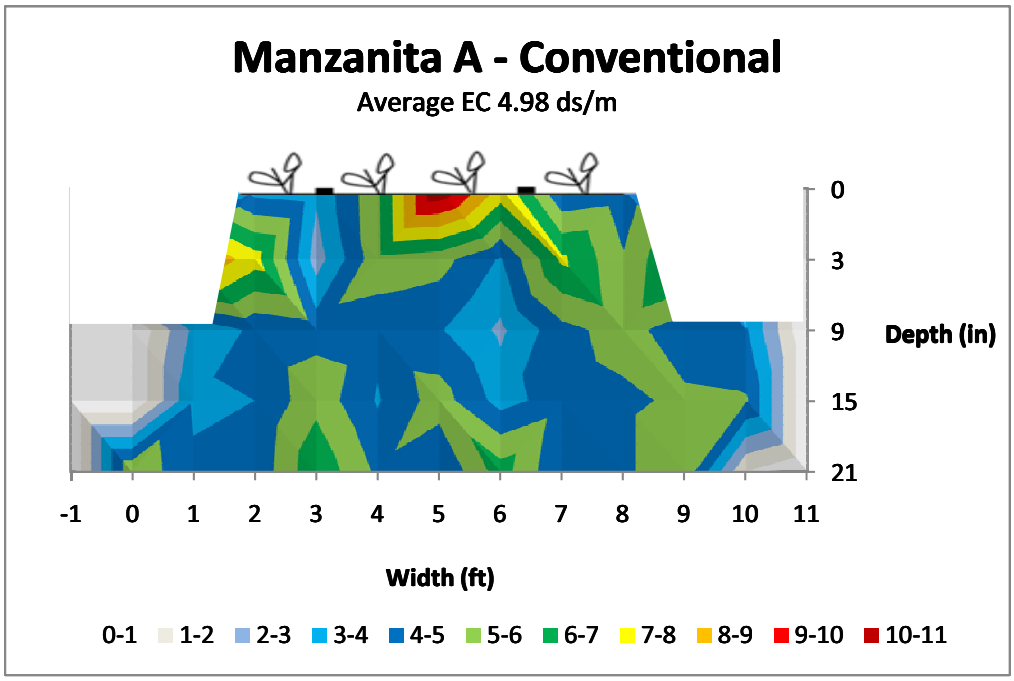


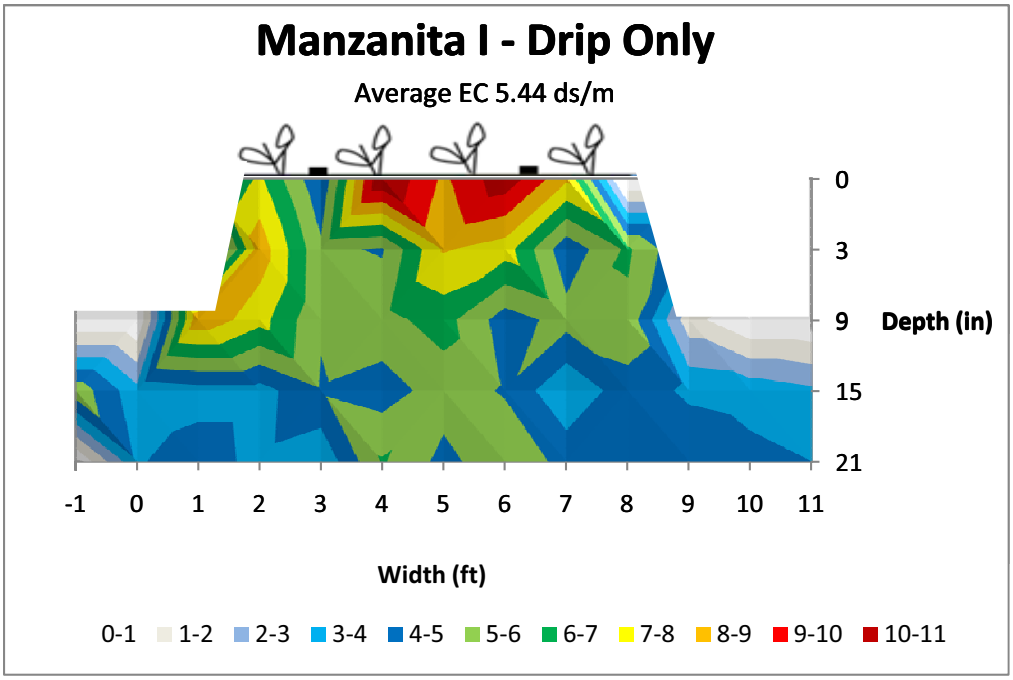
Manzanita
3-Jun-10
Block A ds/m



Salinity Contours

Date: 06/30/10





Detailed Water Analysis

Water Analysis of Strawberries - Sammis Blocks

	10/17/2009	10/31/2009	3/24/2010	5/26/2010		
Sodium (ppm)	118	135	136	151		
Calcium (ppm)	59	63	92	9		
Magnesium (ppm)	37	40	65	54		
Carbonate (ppm)	0	0	0	0		
Bicarbonate (ppm)	238	253	125	52		
Chloride (ppm)	118	134	134	124		
Conductivity (dS/m)	1	1	1	2		
pH	8	8	7	3		
Iron (ppm)	0	<0.04	0	0		
Manganese (ppm)	<0.01	<0.01	0	0		
Phosphorus (ppm)	2	2	1	2		
Potassium (ppm)	11	11	10	11		
Nitrate (ppm)	27	29	17	16		
Sulfate (ppm)	164	186	438	501		
Boron (ppm)	0	0	0	1		
Dissolved Solids (ppm)	774	855	1021	923		
Adjusted S.A.R.	3	4	3	4		

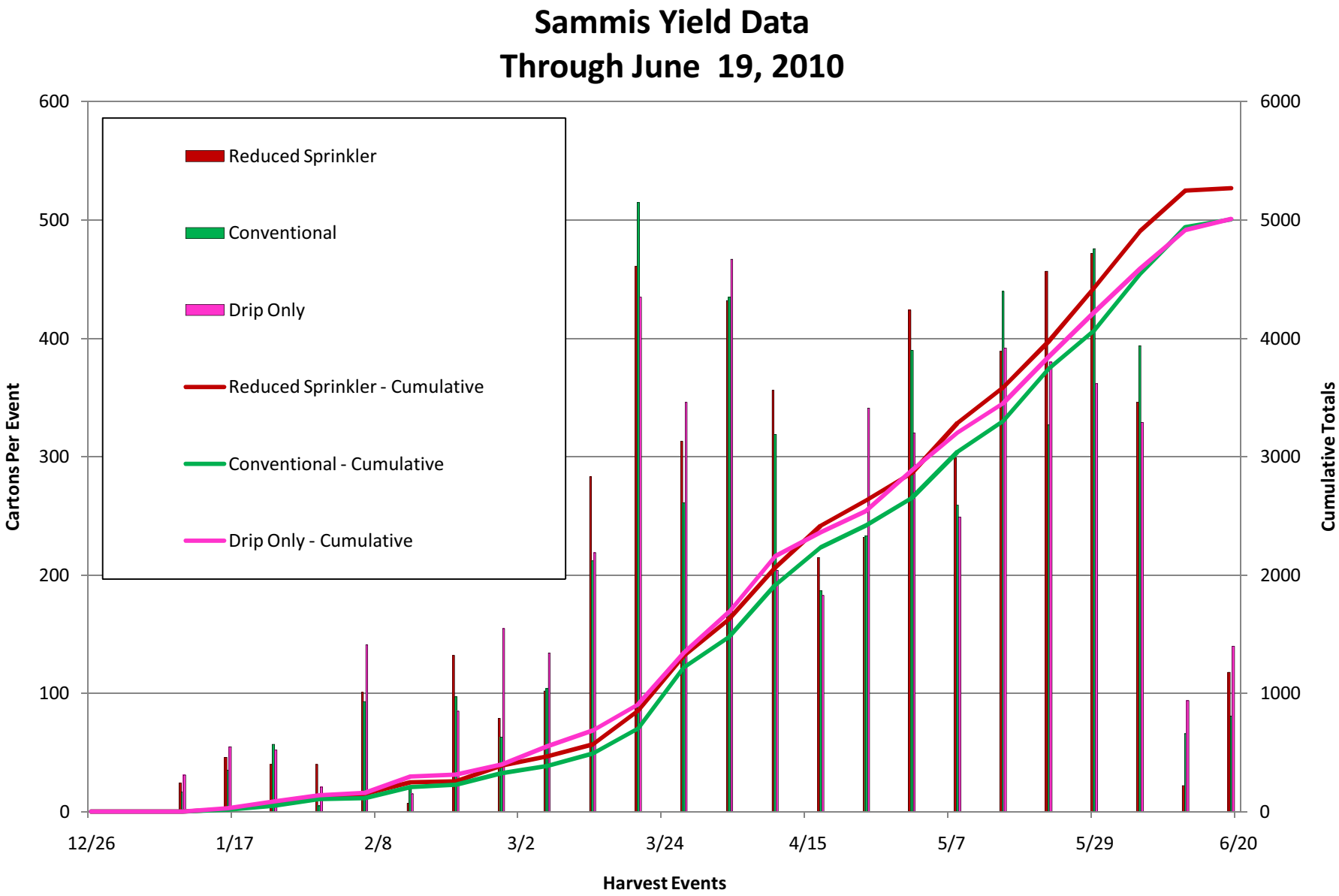
Water Analysis of Strawberries - Eclipse Blocks

	10/7/2009	10/17/2009	10/31/2009	3/24/2010	5/26/2010	
Sodium (ppm)	106	88	94	85	96	
Calcium (ppm)	114	116	123	156	145	
Magnesium (ppm)	43	39	45	57	55	
Carbonate (ppm)	0	0	0	0	0	
Bicarbonate (ppm)	336	247	195	345	192	
Chloride (ppm)	56	42	54	41	46	
Conductivity (dS/m)	1	1	1	1	1	
pH	8	8	7	8	8	
Iron (ppm)	<0.04	<0.04	<0.04	0	0	
Manganese (ppm)	<0.01	<0.01	<0.01	<0.01	0	
Phosphorus (ppm)	0	0	0	0	0	
Potassium (ppm)	7	6	6	4	4	
Nitrate (ppm)	12	8	8	10	2	
Sulfate (ppm)	356	383	427	414	542	
Boron (ppm)	1	1	1	1	1	
Dissolved Solids (ppm)	1031	931	953	1113	1082	
Adjusted S.A.R.	3	2	2	2	2	

Water Analysis of Strawberries - Manzanita Blocks

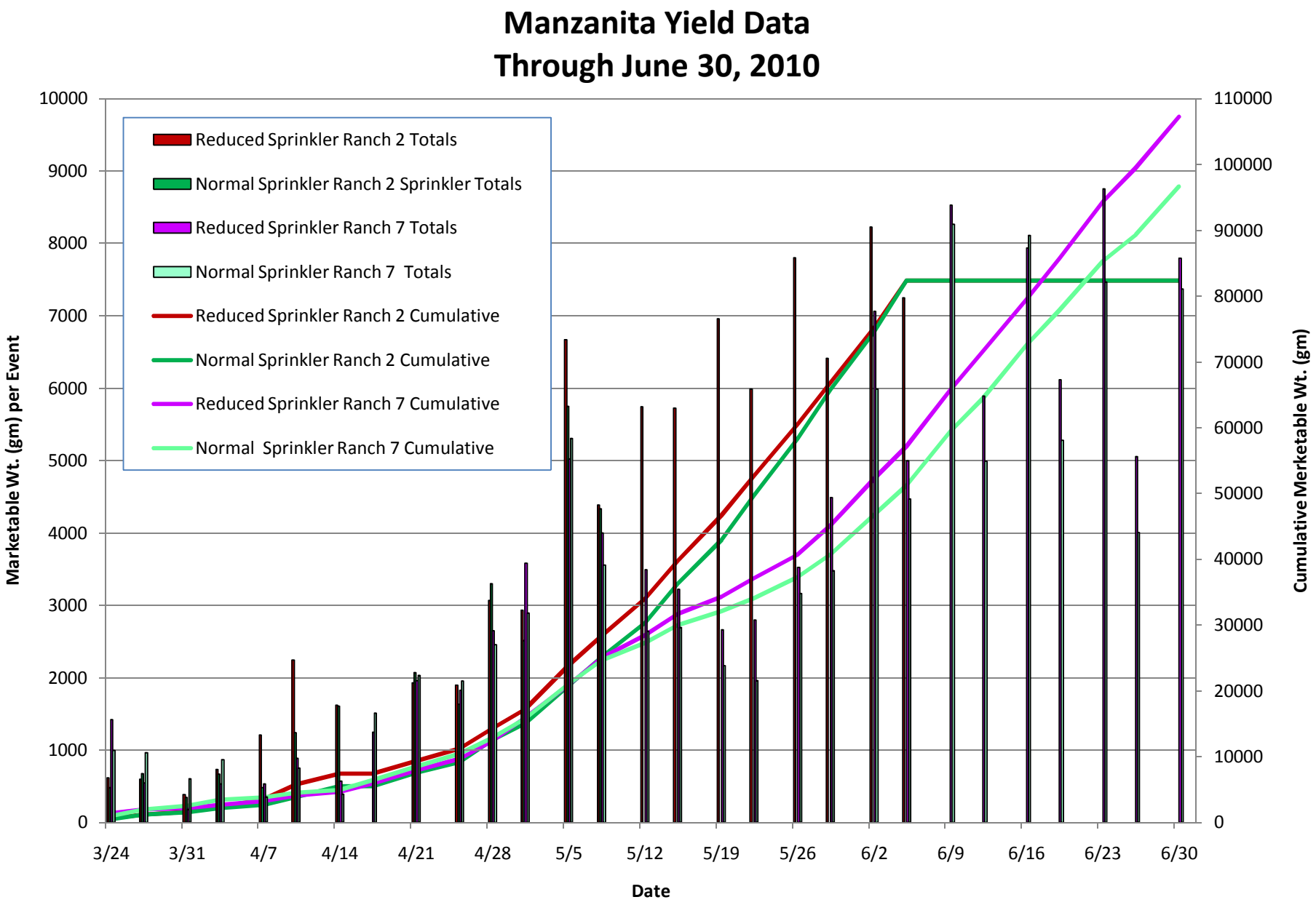
	4/12/2010	6/3/2010				
Sodium (ppm)	71	67				
Calcium (ppm)	153	139				
Magnesium (ppm)	77	68				
Carbonate (ppm)	0	0				
Bicarbonate (ppm)	363	354				
Chloride (ppm)	56	18				
Conductivity (dS/m)	1	1				
pH	8	8				
Iron (ppm)	<0.04	<0.04				
Manganese (ppm)	<0.01	<0.01				
Phosphorus (ppm)	<0.01	0				
Potassium (ppm)	4	4				
Nitrate (ppm)	28	26				
Sulfate (ppm)	416	389				
Boron (ppm)	0	0				
Dissolved Solids (ppm)	1170	1065				
Adjusted S.A.R.	2	1				

Detailed Yield Data


Sammis Yield Data
Through June 19, 2010
Reduced Sprinkler
Conventional
Drip Only
Reduced Sprinkler - Cumulative
Conventional - Cumulative
Drip Only - Cumulative
Cartons Per Event
Cumulative Totals
Harvest Events
600
500
400
300
200
100
0
6000
5000
4000
3000
2000
1000
0
12/26
1/17
2/8
3/2
3/24
4/15
5/7
5/29
6/20

Sammis Yield Data

	Cartons per Event			Cumulative Totals		
	EL DORADO / 2.96	EL DORADO / 2.98	EL DORADO / 3.02	EL DORADO / 2.96	EL DORADO / 2.98	EL DORADO / 3.02
	1090418010	1090418009	1090418011	1090418010	1090418009	1090418011
	10/11/2009	10/11/2009	10/11/2009	10/11/2009	10/11/2009	10/11/2009
	BLACK	BLACK	BLACK	BLACK	BLACK	BLACK
	FRESHDUG	FRESHDUG	FRESHDUG	FRESHDUG	FRESHDUG	FRESHDUG
	NO	NO	NO	NO	NO	NO
	3 DAY SPRK	0 DAY SPRK	NA	3 DAY SPRK	0 DAY SPRK	NA
	BEDFUME	BEDFUME	BEDFUME	BEDFUME	BEDFUME	BEDFUME
	NA	NA	NA	NA	NA	NA
	LOW	LOW	LOW	LOW	LOW	LOW
Date	**Reduced Sprinkler**	**Drip Only**	**Conventional**	**Reduced Sprinkler - Cumulative**	**Drip Only - Cumulative**	**Conventional - Cumulative**
12/26/2009	0	0	0	0	0	0
1/2/2010	0	0	0	0	0	0
1/9/2010	24	31	17	0	0	0
1/16/2010	46	55	35	24	31	17
1/23/2010	40	52	57	70	86	52
1/30/2010	40	21	5	110	138	109
2/6/2010	101	141	93	150	159	114
2/13/2010	7	15	21	251	300	207
2/20/2010	132	85	97	258	315	228
2/27/2010	79	155	63	390	400	325
3/6/2010	102	134	104	469	555	388
3/13/2010	283	219	212	571	689	492
3/20/2010	461	435	515	854	908	704
3/27/2010	313	346	261	1315	1343	1219
4/3/2010	432	467	435	1628	1689	1480
4/10/2010	356	204	319	2060	2156	1915
4/17/2010	215	183	187	2416	2360	2234
4/24/2010	232	341	233	2631	2543	2421
5/1/2010	424	320	390	2863	2884	2654
5/8/2010	299	249	259	3287	3204	3044
5/15/2010	389	392	440	3586	3453	3303
5/22/2010	457	380	327	3975	3845	3743
5/29/2010	472	362	476	4432	4225	4070
6/5/2010	346	329	394	4904	4587	4546
6/12/2010	22	94	66	5250	4916	4940
6/19/2010	118	140	81	5272	5010	5006
Totals	**5,390**	**5,150**	**5,087**	**5390**	**5150**	**5087**


Manzanita Yield Data
Through June 30, 2010
Reduced Sprinkler Ranch 2 Totals
Normal Sprinkler Ranch 2 Sprinkler Totals
Reduced Sprinkler Ranch 7 Totals
Normal Sprinkler Ranch 7 Totals
Reduced Sprinkler Ranch 2 Cumulative
Normal Sprinkler Ranch 2 Cumulative
Reduced Sprinkler Ranch 7 Cumulative
Normal Sprinkler Ranch 7 Cumulative
Marketable Wt. (gm) per Event
Cumulative Merketable Wt. (gm)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
110000
3/24
3/31
4/7
4/14
4/21
4/28
5/5
5/12
5/19
5/26
6/2
6/9
6/16
6/23
6/30
Date

Manzanita Yield Data

Ranch #2																
	Plots 40-44								Plots 45-49							
	Reduced Sprinkler Ranch 2 Totals				Reduced Sprinkler Ranch 2 Cumulative				Normal Sprinkler Ranch 2 Sprinkler Totals				Normal Sprinkler Ranch 2 Cumulative			
Date	No. Berries	Total Weight (gm)	Marketable Berries	Marketable Weight (gm)	No. Berries	Total Weight (gm)	Marketable Berries	Marketable Weight (gm)	No. Berries	Total Weight (gm)	Marketable Berries	Marketable Weight (gm)	No. Berries	Total Weight (gm)	Marketable Berries	Marketable Weight (gm)
3/24	149	3203	17	613	149	3203	17	613	141	2941	13	478	141	2941	13	478
3/27	75	1981	18	594	224	5184	35	1207	84	2401	20	675	225	5342	33	1153
3/31	78	2135	9	384	302	7319	44	1591	98	2594	10	348	323	7936	43	1501
4/3	98	2387	18	730	400	9706	62	2321	76	1844	15	666	399	9780	58	2167
4/7	78	2493	22	1206	478	12199	84	3527	66	1592	11	479	465	11372	69	2646
4/10	79	3035	47	2245	557	15234	131	5772	64	2149	25	1237	529	13521	94	3883
4/14	89	3234	39	1617	646	18468	170	7389	83	3398	34	1609	612	16919	128	5492
4/17	0	0	0	0	646	18468	170	7389	0	0	0	0	612	16919	128	5492
4/21	155	5934	48	1926	801	24402	218	9315	157	6587	46	2073	769	23506	174	7565
4/25	139	4660	46	1898	940	29062	264	11213	122	4004	41	1634	891	27510	215	9199
4/28	284	7736	84	3068	1224	36798	348	14281	245	7842	90	3298	1136	35352	305	12497
5/1	185	4952	93	2929	1409	41750	441	17210	183	5081	78	2511	1319	40433	383	15008
5/5	287	8262	207	6670	1696	50012	648	23880	278	8292	170	5749	1597	48725	553	20757
5/8	260	6007	154	4387	1956	56019	802	28267	247	6263	138	4337	1844	54988	691	25094
5/12	281	7058	191	5745	2237	63077	993	34012	247	6592	167	5244	2091	61580	858	30338
5/15	288	7150	184	5723	2525	70227	1177	39735	289	7613	190	5945	2380	69193	1048	36283
5/19	283	8157	230	6958	2808	78384	1407	46693	292	8557	205	6650	2672	77750	1253	42933
5/22	329	7486	214	5987	3137	85870	1621	52680	355	9228	230	6810	3027	86978	1483	49743
5/26	494	11002	285	7803	3631	96872	1906	60483	499	11354	315	8539	3526	98332	1798	58282
5/29	365	7652	282	6413	3996	104524	2188	66896	421	9330	323	7505	3947	107662	2121	65787
6/2	533	10659	367	8225	4529	115183	2555	75121	566	11539	380	8704	4513	119201	2501	74491
6/5	478	9186	337	7251	5007	124369	2892	82372	486	9559	364	7859	4999	128760	2865	82350
6/9	0	0	0	0	5007	124369	2892	82372	0	0	0	0	4999	128760	2865	82350
6/12	0	0	0	0	5007	124369	2892	82372	0	0	0	0	4999	128760	2865	82350
6/16	0	0	0	0	5007	124369	2892	82372	0	0	0	0	4999	128760	2865	82350
6/19	0	0	0	0	5007	124369	2892	82372	0	0	0	0	4999	128760	2865	82350
6/23	0	0	0	0	5007	124369	2892	82372	0	0	0	0	4999	128760	2865	82350
6/26	0	0	0	0	5007	124369	2892	82372	0	0	0	0	4999	128760	2865	82350
6/30	0	0	0	0	5007	124369	2892	82372	0	0	0	0	4999	128760	2865	82350

Ranch #7																
	Plots 78-82								Plots 83-87							
	Reduced Sprinkler Ranch 7 Totals				Reduced Sprinkler Ranch 7 Cumulative				Normal Sprinkler Ranch 7 Totals				Normal Sprinkler Ranch 7 Cumulative			
Date	No. Berries	Total Weight (gm)	Marketable Berries	Marketable Weight (gm)	No. Berries	Total Weight (gm)	Marketable Berries	Marketable Weight (gm)	No. Berries	Total Weight (gm)	Marketable Berries	Marketable Weight (gm)	No. Berries	Total Weight (gm)	Marketable Berries	Marketable Weight (gm)
3/24	142	3937	41	1421	142	3937	41	1421	149	3597	31	994	149	3597	31	994
3/27	98	2419	18	547	240	6356	59	1968	112	2880	32	961	261	6477	63	1955
3/31	105	2690	6	179	345	9046	65	2147	141	3934	21	603	402	10411	84	2558
4/3	53	1341	16	534	398	10387	81	2681	84	2146	27	866	486	12557	111	3424
4/7	94	2774	12	533	492	13161	93	3214	62	1594	10	354	548	14151	121	3778
4/10	62	2009	19	885	554	15170	112	4099	65	1900	16	754	613	16051	137	4532
4/14	93	3360	14	569	647	18530	126	4668	68	2493	9	392	681	18544	146	4924
4/17	58	2026	28	1245	705	20556	154	5913	80	2574	32	1511	761	21118	178	6435
4/21	156	6950	44	1963	861	27506	198	7876	131	6039	48	2034	892	27157	226	8469
4/25	83	2883	45	1825	944	30389	243	9701	94	3437	41	1956	986	30594	267	10425
4/28	214	7255	69	2646	1158	37644	312	12347	180	7230	57	2458	1166	37824	324	12883
5/1	221	5467	97	3584	1379	43111	409	15931	189	4760	77	2893	1355	42584	401	15776
5/5	217	6138	150	5024	1596	49249	559	20955	256	7002	141	5305	1611	49586	542	21081
5/8	242	5814	126	4001	1838	55063	685	24956	201	4912	93	3558	1812	54498	635	24639
5/12	224	4384	115	3495	2062	59447	800	28451	174	4022	79	2644	1986	58520	714	27283
5/15	231	4290	104	3220	2293	63737	904	31671	169	3356	82	2691	2155	61876	796	29974
5/19	161	4002	89	2663	2454	67739	993	34334	166	3334	76	2167	2321	65210	872	32141
5/22	184	4026	101	2797	2638	71765	1094	37131	138	2857	73	1958	2459	68067	945	34099
5/26	227	4790	132	3522	2865	76555	1226	40653	194	4124	123	3163	2653	72191	1068	37262
5/29	239	5694	171	4487	3104	82249	1397	45140	180	4431	121	3476	2833	76622	1189	40738
6/2	387	8472	295	7061	3491	90721	1692	52201	361	7632	235	5988	3194	84254	1424	46726
6/5	313	6443	206	4996	3804	97164	1898	57197	280	6206	178	4469	3474	90460	1602	51195
6/9	459	10222	349	8529	4263	107386	2247	65726	437	10286	319	8269	3911	100746	1921	59464
6/12	385	7835	269	5891	4648	115221	2516	71617	352	7253	225	4992	4263	107999	2146	64456
6/16	535	10384	380	7936	5183	125605	2896	79553	504	10036	362	8113	4767	118035	2508	72569
6/19	419	7640	306	6115	5602	133245	3202	85668	357	7034	248	5278	5124	125069	2756	77847
6/23	609	11374	430	8757	6211	144619	3632	94425	499	9783	346	7468	5623	134852	3102	85315
6/26	422	7097	280	5057	6633	151716	3912	99482	418	7274	214	4004	6041	142126	3316	89319
6/30	639	10381	440	7794	7272	162097	4352	107276	578	10293	393	7372	6619	152419	3709	96691